1975

A programmed loading procedure for containerized cargo ships.

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A PROGRAMMED LOADING PROCEDURE FOR CONTAINERIZED CARGO SHIPS

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THESIS

A PROGRAMMED LOADING PROCEDURE FOR
CONTAINERIZED CARGO SHIPS

by

Tran Quang Thieu

June 1975

Thesis Advisor: James P. Hynes

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Programmed Loading Procedure for Containerized Cargo Ships		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis June 1975 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Tran Quang Thieu		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE June 1975 13. NUMBER OF PAGES 98
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Logistics
Containerization
Sealift

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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The purpose of the programmed procedure is to minimize time

20. Continued

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The procedure is presented in simple flowcharts and in a detailed FORTRAN IV program. An illustration, which was made as realistic as possible was given and the complete computer printout are attached.

A Programmed Loading Procedure for Containerized Cargo Ships

by

TRAN QUANG THIEU

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1975

ABSTRACT

A programmed loading procedure for containerized cargo ship is developed. The model requires input information on the containers to be loaded, the ship's design and hydrostatic properties, and the specific order of port calls to be made in the voyage.

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The procedure is presented in simple flowcharts and in a detailed FORTRAN IV program. An illustration, which was made as realistic as possible was given and the complete computer printout are attached.

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I. DEVELOPMENT OF CONTAINERIZATION

In 1929, a new idea was developed in the transportation field. Some of the ships operating in coast-wise and contiguous trade were specially outfitted to carry the trucks, trailers and railroad freight cars. Unfortunately, the great potential of this concept was not fully developed due to the lack of standardization. It was not until the mid-nineteen fifties that the next step in the development occurred. Ships were specially designed to carry standard containers. Cargo was stuffed into containers before ships entering the port. Loading and unloading became much more easy, and in the nineteen-sixties containerization was fully developed. Common cargo containers were fully transferable among the various modes of transportation. However, ships were the most important container carriers; in 1966 the first fully-containerized ship entered into the foreign trade market, and later on, the second generation American containerized ship, the LANCER class, commenced operations in 1968-1969.

II. THE PROBLEM

Generally speaking, when containers have been assigned to a specific ship the following factors must be considered.

a. Proper grouping of a consignee's cargo and container accessibility in the marshalling yard.

b. The order of the port calls in the voyage, i.e., containers must be stowed in such a way that there should be no overstow of cargo for a later port over cargo for an earlier port call.

c. Special stowage requirements for hazardous types of cargo or reefer containers requiring access to electrical outlets.

d. Arrangement of weights to meet the ship trim, list, and stability requirements.

Satisfying all these conditions simultaneously becomes a very complex task when there are several loading ports in the voyage. Years after the beginning of containerization, there remains to be developed an effective load planning procedure that can handle all factors. The actual methods now being used vary from company to company. Most of them are manual and based on "trial and error" procedure. They are all time-consuming and consequently leave something to be desired.

III. INTRODUCTION OF A PROPOSED PROCEDURE

In the past, the old "trial and error" methods were more or less adequate to handle the problem. Now that larger ships are being built, changes must be made in order to promote more efficient use of the investment in a vessel. In general, our objective is to reduce the time in port of a ship for loading and unloading. The time would be minimized if the unloading does not require extra movement of containers aboard the vessel, and this, of course, is accomplished by avoiding overstow. Certainly all the factors mentioned in the previous section must be met. In short, to minimize the time in port of a ship means to minimize the overstow, subject to loading constraints. With the assistance of a computer, the goal is attainable. In the next chapter a loading procedure is proposed; calculations of ship's trim, list and stability will be introduced in another chapter. The procedure then is translated into FORTRAN IV language and a somewhat realistic illustration with a complete computer print-out will be given.[1]

[1] This chapter and Appendix A, were based on a previous study by Dewey E. Beliech, Jr.

IV. ASSUMPTIONS

We shall first assume the following conditions for the model.

A. THE CONTAINER

A container is a box containing cargo. All containers are assumed to be the same size for this procedure.

B. THE SHIP

In general it is not required the ship have any special form. However, for purposes here, it will be assumed that the ship has nine different cargo holds.[2] Holds vary in sizes, but all can be vertically accessed to any place. In other words, the hatches are as large as the holds. This is generally not a restrictive assumption.

C. THE VOYAGE

The order of port calls in the voyage must be specific and fixed. We can assume, without losing generality, that the ship is making a "circle" trip from port-1 to port-n and after that returning to port-1, (not port-n-1).See Figure 1.

It is assumed that containers are unloaded and loaded at each port in the voyage. Also, it is assumed that the number of containers to be loaded at a port will never be

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[2]The reason for assuming nine holds will be explained in the assumptions about labeled cargo mentioned later in this chapter.

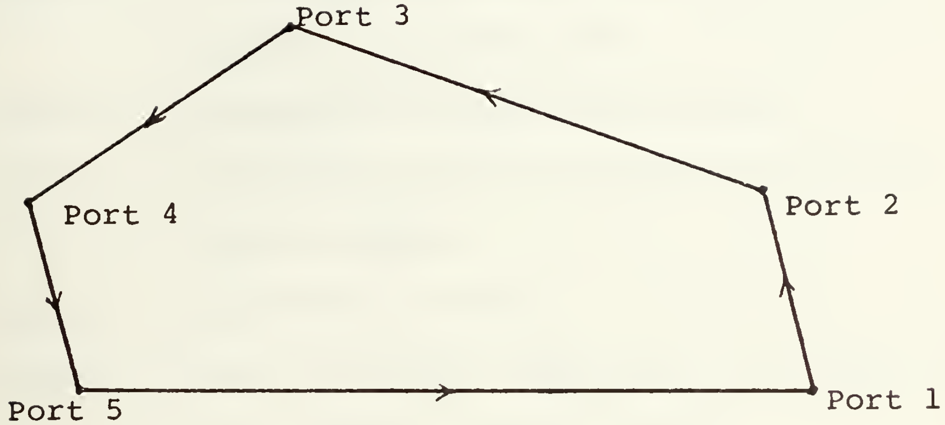

Figure 1: A five port voyage.

greater than the number unloaded at the port. This latter assumption is needed to insure that there is always sufficient space available for loading.

D. THE CARGO

Both labeled and common cargo can be carried, and are classified into the following nine types:

- Type-1 [3] Explosives.
- Type-2 Inflammable compressed gas (RED GAS) e.g., Butane, LPG, Acetylene.
- Type-3 Inflammable liquids (RED LABEL).
- Type-4 Inflammable solids/oxidizing materials (YELLOW LABEL).
- Type-5 Hazardous articles.
- Type-6 Non-inflammable compressed gas (GREEN LABEL) e.g., Oxygen, Freon, Helium.
- Type-7 Poisonous articles (BLUE LABEL).
- Type-8 Corrosive liquids (WHITE LABEL).
- Type-9 Common cargo.

The first eight types of cargo listed are labeled. Based on Department of Transportation regulations for stowage, most of the labeled cargo types can not be stowed in the same hold. There is no restriction on common cargo. However, type-2 and type-5 cargo are required to be stowed on deck. Refrigerated cargo could be classed as an other type and stowed into a separate hold, however, in this study we

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[3] Type number were arbitrarily selected for programming purpose.

neglect that by assuming as far as refrigerated cargo and containers are concerned, each container is a refrigerator itself, and accessibility to electrical outlets is assumed available around the ship. For more detailed rules of stowage for the labeled cargo, see Appendix A.

V. THE MODEL

A. MATHEMATICAL PROGRAMMING APPROACH

As stated briefly in the introduction, the ultimate objective is to minimize the in-port time of the ship in order to maximize the productivity of the vessel. Port time for a ship is dependent on the number of container movements required aboard the vessel to discharge containers for the port, and to load containers from the port. As previously pointed out, this is accomplished by minimizing overstow. So in terms of a mathematical programming approach, the problem can be stated as:

Objective Function: Minimize (number of overstow containers)

Subject to: - Storage regulations

- Ship's trim, list, stability requirements.

Conceptually, it appears that the problem can be solved using an Integer-Programming technique. Unfortunately, an initial investigation revealed that for a vessel of even small size, the number of variables would far exceed the capacities of contemporary software and computing machinery. Therefore, it was assumed that pursuing simple mathematical programming approaches would not be fruitful in the short run.

B. HEURISTIC APPROACH

While the mathematical programming is reluctantly discounted, a heuristic approach appeared to be more productive

way of initially grappling with the problem because there exists a set of loading heuristics which simplify the problem. These heuristics, or rules of thumbs, are detailed below. They may not always lead to an optimal solution, but at worst they can be used to get a solution which is more or less optimal. In this sense, the emphasis here is on obtaining workable solutions which more or less minimize overstow. This, of course, is a reflection of the heuristic "philosophy" of problem solving.[4]

1. <u>Loading Heuristics</u>

a. Higher-Sooner

To eliminate, or minimize, overstow the well known "last-in-first-out" procedure is used here. Suppose that containers are being loaded at port-1 (see Figure 1) then all containers destined to port-5 should be at the bottom of each container stack on the vessel. The containers at the top of a stack should be destined to port-2. It can be said that to eliminate overstow, containers for the same POD should be stowed together in the same stack, however, if they cannot all be in the same stack, then the containers for earlier ports should be above the containers for later ports.

b. Higher-Lighter

Ship's stability will be assured if, in any stack of containers, the higher the container is, the

[4]Murray A. Jeisler & Wilber A. Steger, "The Combination of Alternative Research Techniques in Logistics Systems Analysis," Management Technology, May 1963, pp. 68-77.

lighter it is. A heavy container loaded below the ship's gravity center tends to lower the gravity center and therefore, increase the righting moment. If not required by regulations, the "higher-lighter" principle is applied here.

c. Left-Right Equality

The ship has no list if equal weights are distributed symetrically with respect to the ship center-line.

d. Heavy-Aftward

Another factor that must be considered is the ship's trim. Usually a slightly deeper aft-draft (trim by the stern) is preferred to keep the ship easily under control. Ship's configurations and ship arrangement vary a great deal. It is almost impossible to set up a general principle regarding distribution of weight along the transverse direction of the ship. However, most ships are constructed such that there are more cargo holds in the forward part than in the aft part. Heavier weights are, therefore, likely to be stowed closer to the stern. Nevertheless, that is not a guarantee. Ship's trim must be calculated before containers are actually being loaded. The difference between aft and forward draft must be within tolerance, or be adjustable by ballasting. The above principles are illustrated through simple examples in Figure 2.

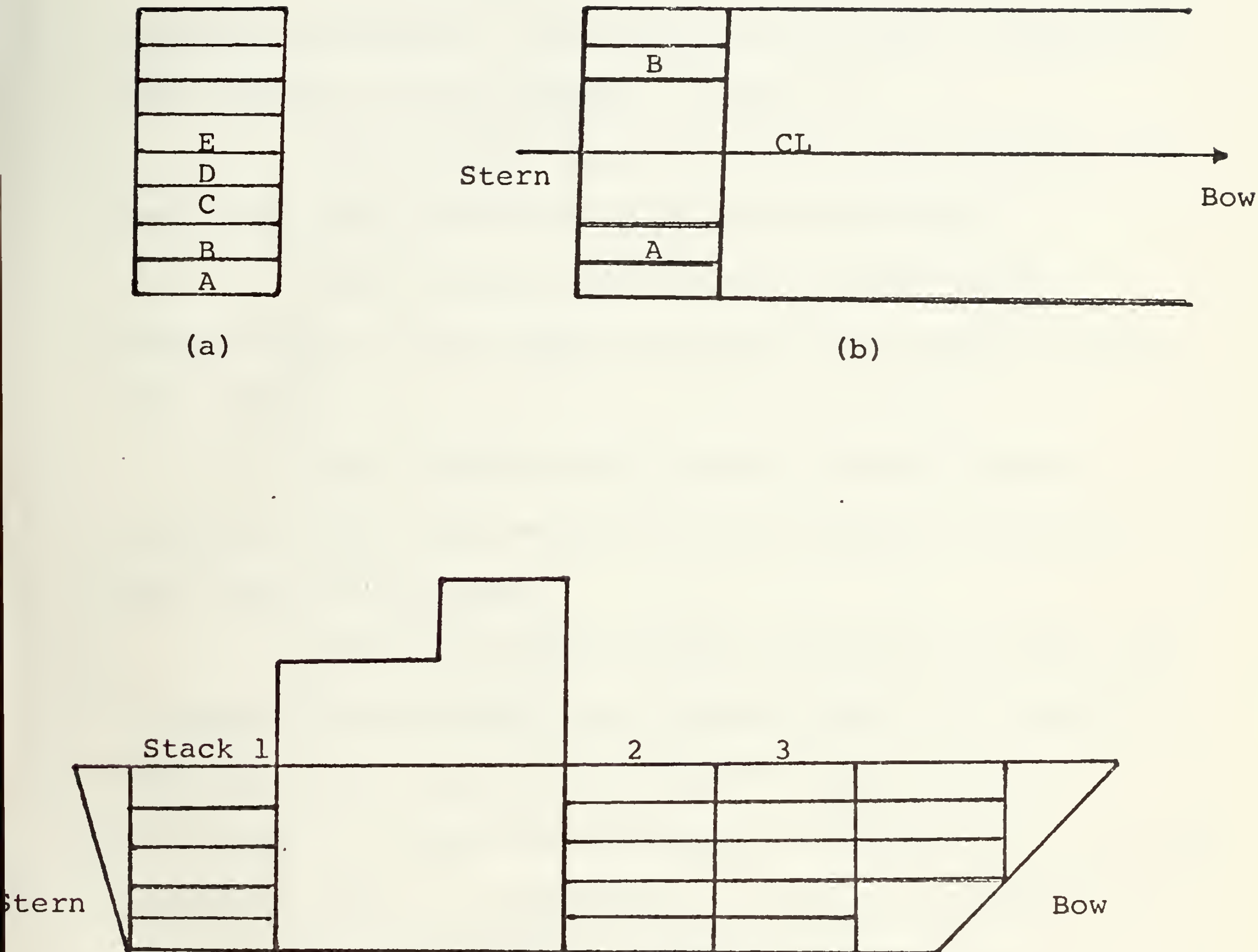

Figure 2: Loading Heuristics

(a) If all containers are being sent to the same port of destination then Weight (A) > Weight (B) > . . . > Weight (E). If those containers are being sent to different ports then; Container E should be destined to an earlier port than container A.

(b) Container A and container B should have the same weight.

(c) Stack-1 should have sufficient weight to counter the weight of stack-2 and 3.

2. <u>The Model</u>

a. System of Coordinates

By using the above heuristics we can develope a loading procedure. For reference purposes, a system of coordinates is first defined. (Figure 3)

Let the XOY plane be the horizontal plane of the lowest deck where containers can be stowed.

Let the XOZ plane be the vertical plane perpendicular to the ship center-line and tangent to the ship stern.

Let the YOZ plane be the vertical plane parallel to the ship center-line and tangent to the left most point of the ship.

Each container storage location, or cell, has an address specified by row, column, and tier. A row of containers is a group of containers having the same Y coordinate. A column of containers is a group of containers having the same X coordinate. A tier of containers is a group of containers having the same Z coordinate.

For example, the container A in Figure 4 has address (4,4,2). In other words, it is at row-4, column-4, tier-2.

b. Load Planning Procedure

Applying the heuristics previously discussed, containers are first sorted into decreasing order of weight. After that, containers are grouped by order of ports of destination and then sub-grouped by types of cargo. This

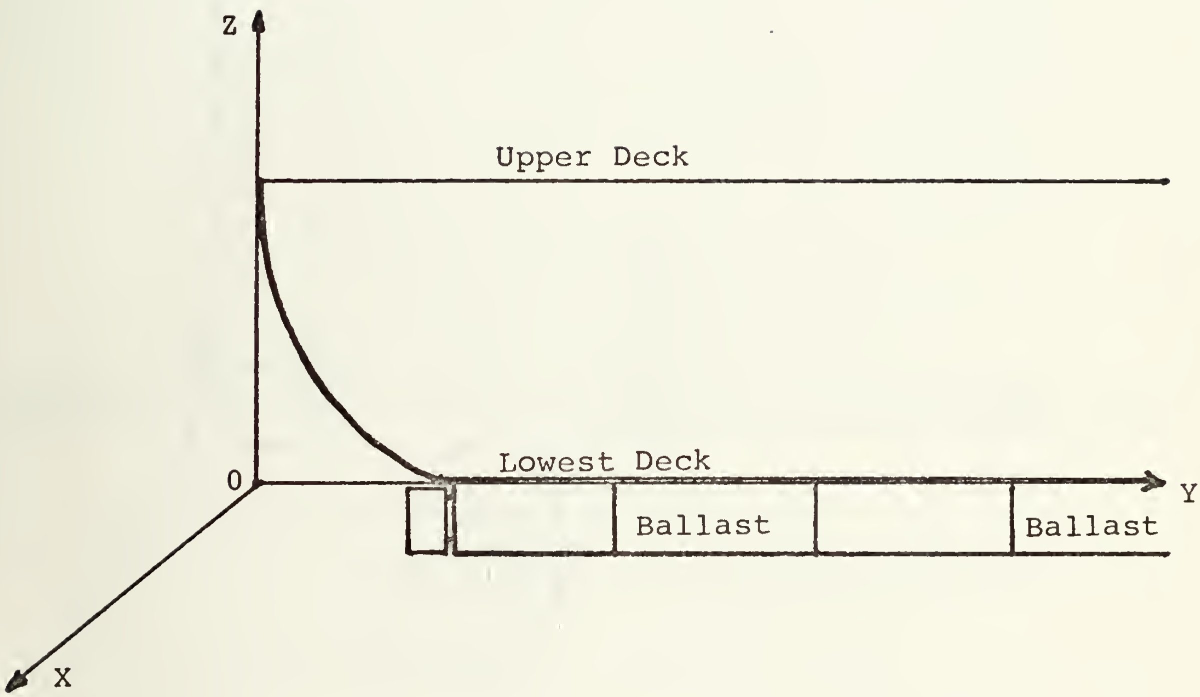

Figure 3: System of Coordinates

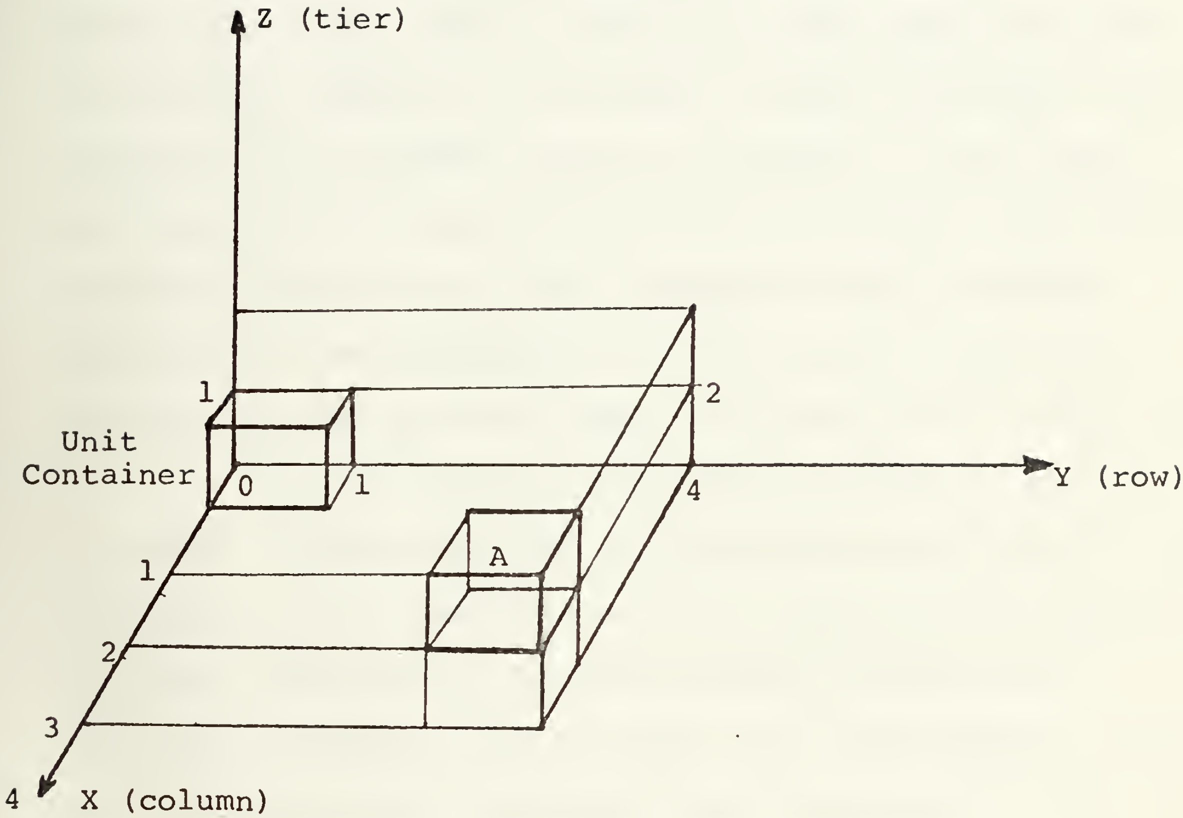

Figure 4: Example Address of a Container

procedure is illustrated by Figure 5. After grouping, containers destined to the last port are assigned to stacks, and assigned to separate holds, depending upon the types of cargo. As an example, containers of type-1 cargo could be assigned to hold (N-1), type-2 cargo assigned to hold (N-2), etc. Now, recall that type-2 and type-5 cargo containers are required to be stowed on deck and common cargo (type-9) can be stowed anyplace; therefore, after type-2 and type-5 cargo containers have been assigned deck spaces, there are "empty holes" left underneath those labeled containers. The holes will be filled up by common cargo containers which have the same (or lower) port of destination.

Ship list is controlled by assigning spaces in a column to the right to the center-line and then assigning spaces in a column to the left, with the same distance from the center line. The total weight of those two columns is generally not the same and a list moment exists, but it is generally slight and can be adjusted by ballasting. If not, stacks can be reassigned before actual loading.

In general, labeled cargo containers are assigned first, following the pattern described above, and illustrated in Figure 6(b). This typically leads to partially occupied stacks, or columns, of containers, and there exist the holes; either underneath or above, which can be filled by common cargo containers.

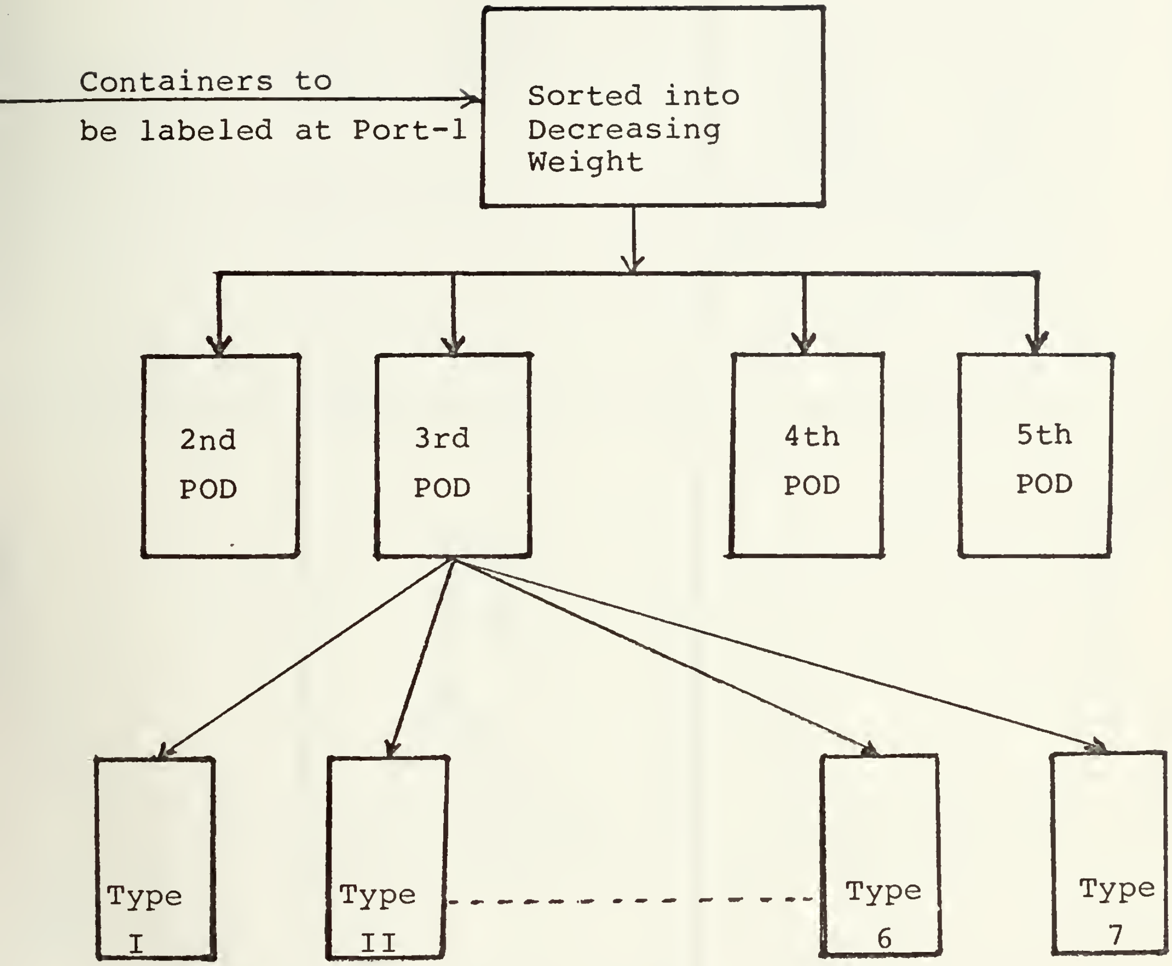

Figure 5: Grouping of Containers

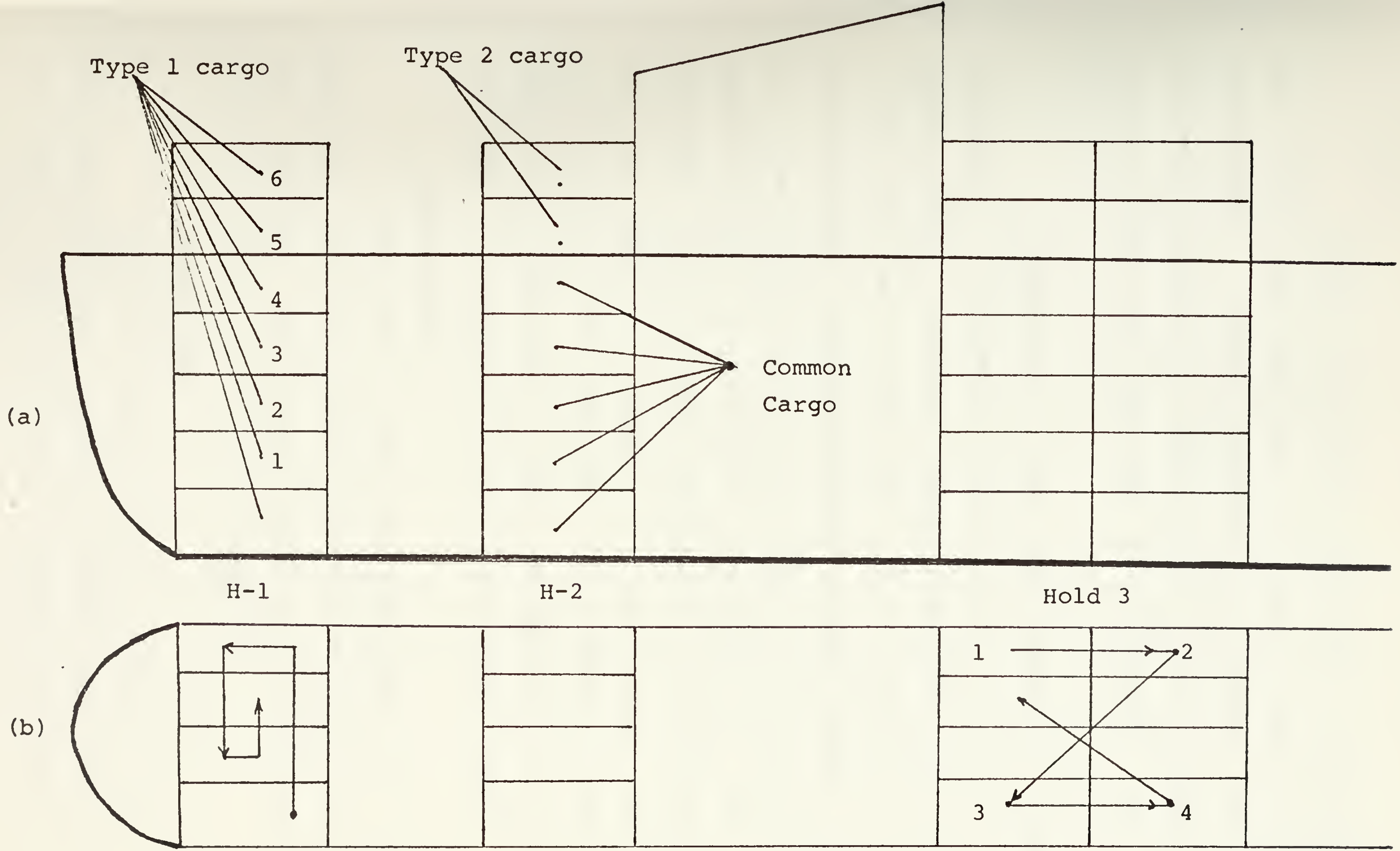

Figure 6: Loading Pattern

Figure 6(a): Weight(1) ≥ Weight(2) ≥ ... ≥ Weight(6).

Figure 6(b): The order of loading of stacks of containers in hold No 3: 1, 2, 3, 4 ... The order is represented by the path with arrows.

After all containers destined to a POD have been loaded, the containers to the next-to-the-last POD are assigned. The same principles are applied, and addresses assigned to a container only if it has been checked to make sure that there is no overstow. See Figure 7.

Another way to look into the model is illustrated in Figure 8. In general, the heuristics are used for container sorting, grouping, address assignment and matching. In the next chapter these tasks will be explained in detail by flow-charts, computer programs and subroutines. However, some words should be said about the matching. An address can be preoccupied by a container or a ship structure. In this case, the address is automatically rejected, and other addresses will be searched, checked, and matched with the container. This feature allows the model to be independent to ship configuration, and allows the model to be applied at every port in the voyage.

3. Calculations

As mentioned in the above paragraphs, the heuristics here do not guarantee that an optimal solution can be reached and, moreover, ship trim and stability must be calculated to assure that the loading is acceptable.

a. Ship Trim

The inclinations in the transverse direction are measured by the difference between the forward and the aft drafts. This difference in drafts is defined as trim.

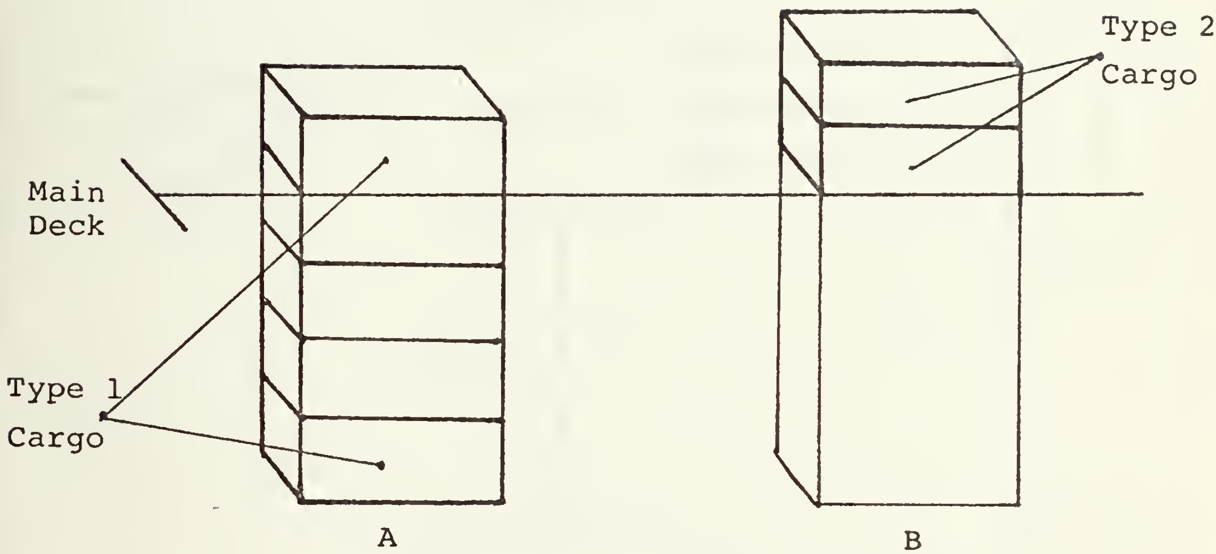

Figure 7: Partially Occupied Stacks
of Containers

A: above hole

B: underneath hole

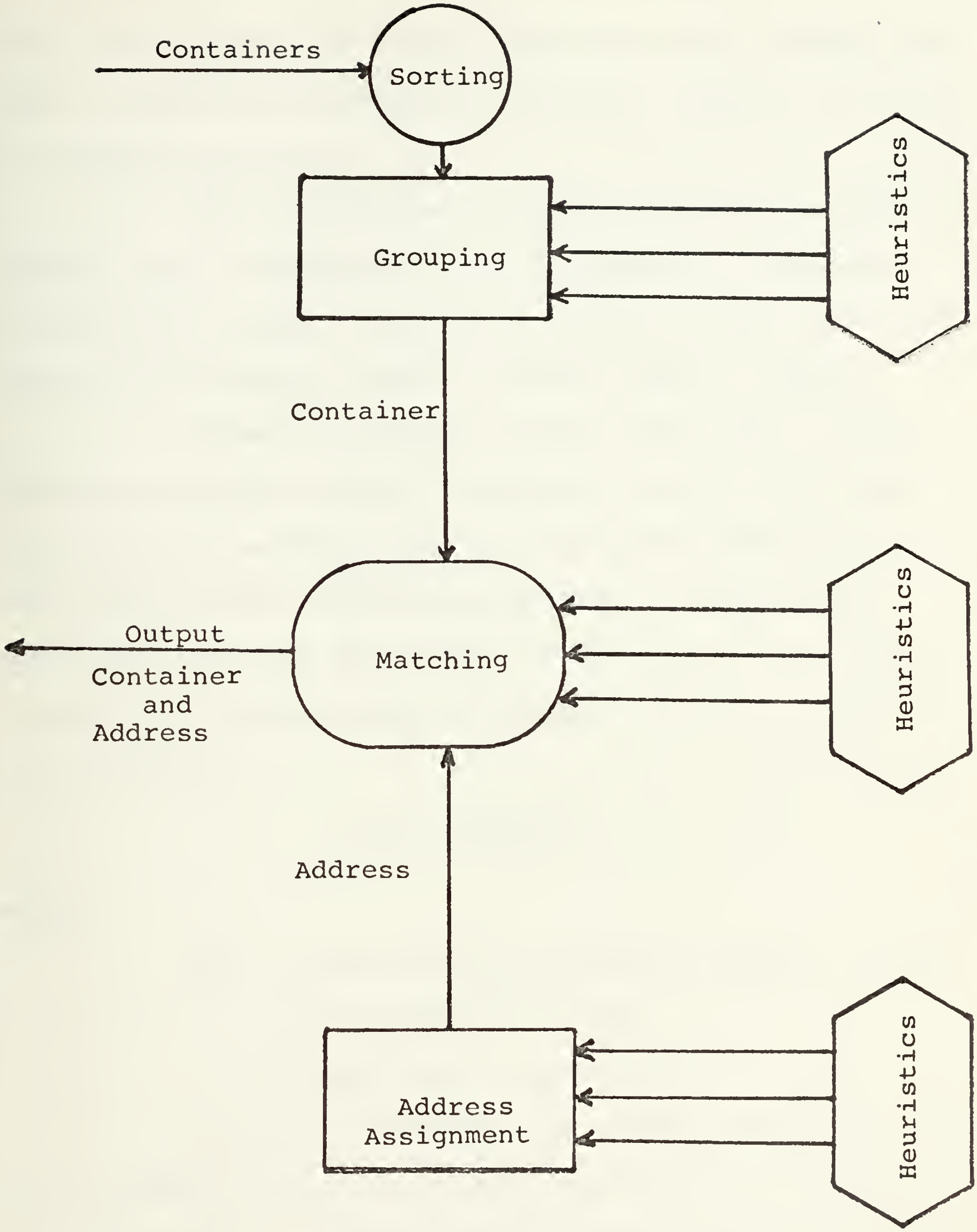

Figure 8: Matching of Containers and Addresses by Selected Heuristics

Where the draft aft is greater than the draft forward, the ship is said to be trimmed by the stern, otherwise the ship is trimmed by the bow.

When a container is loaded onboard, the trim changes, and the change of trim is defined as the change in difference between the drafts forward and aft. To calculate this change we need to define some new terms:

- Moment to change trim one inch, MTI, is the moment required to produce a change of trim by one inch. This value varies depending upon the displacement of the ship and therefore, upon the mean draft. It is often found as a curve in the "Curves of the form."[5] When such a curve is not immediately available, MTI can be computed by the formula:

$$MTI = \frac{BM' \times W}{12\ L} .$$

Where:

BM' = longitudinal metacentic radius (in feet)

W = displacement (in ton)

L = ship length (in feet)

- Center of flotation (CF): The geometric center of the waterline plan is called the center of flotation. For ship trim, it inclines about an axis through the center. For practical purposes, flotation center is assumed at midship or at a point with a distance d from midship; where

[5]NAVPERS 91067, Principles of Stability in Ship Loading, page 69, Bureau of Naval Personnel, 1949.

d is the average distance of distances from the midship to the points on the locus of flotation center.

Thus, if a container with weight equal to w, is loaded at a distance t from CF, the change of trim is:

$$T = \text{Change in trim} = \frac{w \times t}{MTI} .$$

and, by the system of coordinates previously defined

New draft, aft = new mean draft - T/2.

New draft, fwd = new mean draft + T/2.

A subroutine to compute these values after each container is assigned to a space is described in the next chapter and is the principal calculation needed to be attached to any loading plan.

b. List and Ship Stability

Experience has shown that the "higher-lighter" and the "left-right equality" heuristics tend to keep ship stability and ship list within limits. Actually, with the same distance from the ship centerline, a right column of containers which are assigned first, is likely to be a little heavier than a left column because the containers are sorted into decreasing order of weight. However, this list moment is assumed negligible for practical purposes, and can be adjusted by ballasting. If an accurate list is desired, it can be computed in almost the same manner as ship trim. The same holds true for stability. An accurate computation involves a complicated read-in of the cross-curves and lengthy adjustments.

VI. THE GENERAL FLOW-CHART

In the previous chapter the model has been described by words. In this chapter it is depicted by a general flow-chart and by FORTRAN IV language in full details. A somewhat realistic example, with five loading ports, 946 containers and the CB-1 containership, is introduced for purposes of illustration.

The general flow-chart depicts the principal steps of the loading plan. First of all, data involving the ship, the voyage, and the containers are read by the program. The addresses which are already occupied either by containers or by ship objects, are registered. Containers are then sorted into decreasing order of weight, grouped by ports and types. The containers already on-board are listed with their addresses. Ship trim affected by those containers is computed and stored.

Next, new containers are selected, assigned addresses, ship trim is computed and accumulated. The addresses of all containers are then printed as a manifest. If any labeled container is not in a proper hold, or if any one overstowed, then its serial number and characteristics are printed out for human interference. Unoccupied addresses, if any, are also listed in relative port order according to containers partially occupying the stacks.

To carry out these tasks, a main program is used with four subroutines. These subroutines are generally described as follows.

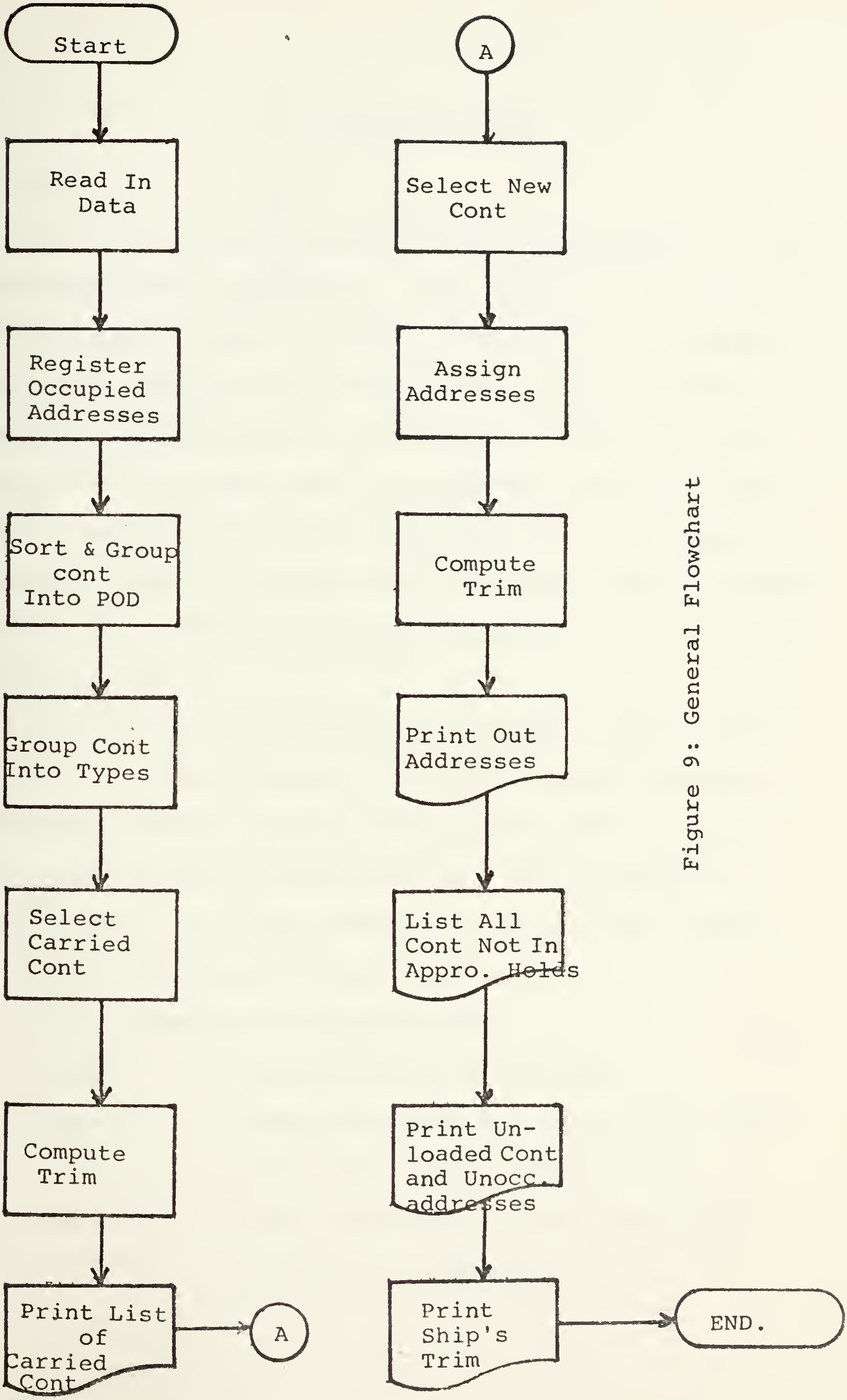

Figure 9: General Flowchart

VII. THE SUBROUTINES

A. SORT

Subroutine "Sort" is used to sort the containers into decreasing order of weights. Data related to a container include: serial number, port of loading, port of distination, cargo type, gross weight, and if already loaded, row-column-tier-address. The weight is used to compare containers with each other; the heaviest container, with all its related data, will be moved to the first place of computer storage. In any later processing, such as address assignment or manifest listing, the heavier containers are considered first.

The data are read by the main program. Following is the list of variable names. Note that "NCONT" includes containers already loaded, "dummy containers", which are merely ship-objects having addresses but no weight or serial number. In fact, NCONT is equal to total number of possible addresses on the ship.

List of Important Variable Names

ICOL(I)	=	Column address of container (I).
IPDEP(I)	=	Number assigned to a port on the route where the container was loaded.
IPARR(I)	=	Number assigned to a port where the container is destined.

IROW(I) = Row address of container (I).

ISER(I) = Container (I) serial number.

ITIER(I) = Tier address of container (I).

ITYPE(I) = Number assigned to the type of cargo stuffed inside the container.

WEIGHT(I) = Gross weight of container (I).

A number of variable names, such as NC, WES, are defined internally, they are used only as temporary storage and do not have any special meaning. For a complete variable name list, see Appendix B. The subroutine is listed in the "Computer Program" Appendix.

B. SUBROUTINE POST

The most important and complicated subroutine is "POST". It is used to assign newly loaded containers. It checks all requirements, all constraints posed by regulations and loading heuristics.

First, a general flow-chart is illustrated in Figure 10. As said before, containers are grouped by types of cargo. The main program has specified the appropriate hold for each type of labeled cargo. This subroutine's first step is to check if the hold is full. If it is full, containers will be stowed in a common hold for manual inspection. The program does not determine in which case stowing is tolerated and in which case it is not. If the appropriate hold is not full, the next address in a well-defined sequence will be offered to the container. The matching

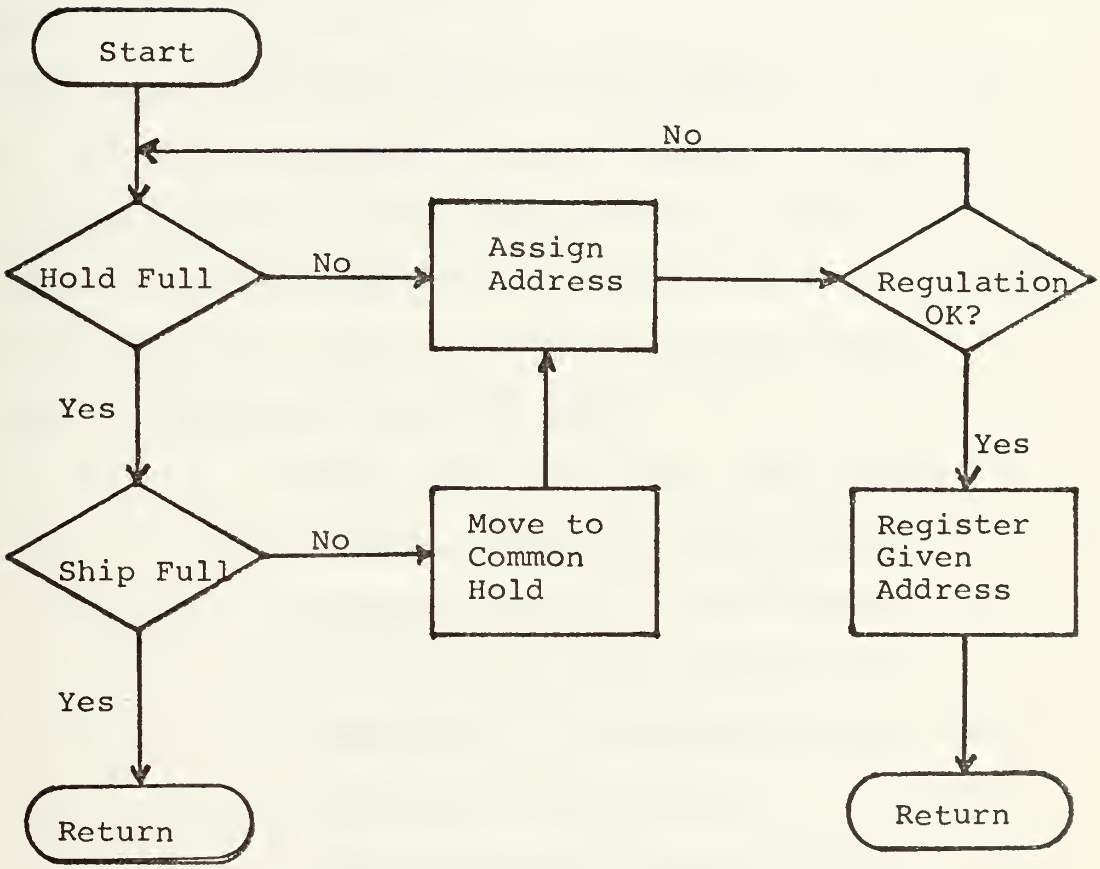

Figure 10: Flow Chart, Subroutine "POST".

will be checked against regulations and if compatible, the address will be registered and returned to main program.

If an address is not acceptable, the next address will be examined. The "next address" is defined as the same row, same column, one-unit-higher tier.

If the new tier address is greater than the maximum, then the new address is one-unit-forward row, same column, tier = 1.

If one-unit-forward takes the row address out of the hold, then the new address is most aftward row, symetric with respect to C/L of old column address, tier = 1.

The data for "POST" are also read by the main program. The following is a list of important variable names.

List of Important Variable Names

K	=	Order of a port under the loading process, where the loading port is assigned number 1. The variable K is relative to the loading port, therefore it is different from IPARR(I) which is a constant while K varies. The loading port can be any port on the route.
L	=	Index assigned to a hold where type-L cargo is stowed.
JC	=	Column address under processing.
JR	=	Row address under processing.
JT	=	Tier address under processing.

JL = First tier address on deck.

KRORIG = Maximum row address of a hold.

MAXROW(L) = Number of rows in a hold. Note that "dummy rows" which are ship objects, must be assigned to an adjacent hold.

MTIER = Maximum value of tier address.

MAXCOL = Maximum value of column address.

MAC = Midship column address.

MLOWER = Maximum value of tier address underneath the main deck.

LOG(JC,JR,JT)= Address characteristics

- LOG(JC,JR,JT) = 0 denotes an unoccupied address.
- LOG(JC,JR,JT) = K denotes a container occupying the address which will be unloaded at port-K, with respect to this loading port.

The complete subroutine is listed in the "Computer Program" Appendix.

C. SUBROUTINES "TRIM" AND "CURVE"

"TRIM" is a subroutine used to compute ship trim. To evaluate mean drafts and MTI's with respect to displacement, an auxiliary subroutine, "CURVE", is needed. The curves of the form are expressed by linear estimation. They are

divided into ten segments, each segment as a linear function of displacement. (AA,BA), (AB,BB),...,(AJ,BJ) are ten ordered pairs of ten points on the draft curve, and (AA,CA), (AB,CB),...,(AJ,CJ) are ten points on the MTI curve. The coordinates of those points are read by the main program and transmitted to "CURVE" through "TRIM".

For a general curve, the coordinates of those ten points are: (XO,YO),(XI,YI),...,(X9,Y9). See Figure 11.

In addition to the variables mentioned above, the following variable names have been used in the subroutines, "TRIM" and "CURVE".

List of Variable Names

A	= Container position and equals row address.
CL	= Container length, in feet.
DIFF	= Difference of mean drafts after a container is loaded.
DISP	= Displacement.
DRAAFT	= Aft draft.
DRAFWD	= Forward draft.
SHLGTH	= Overall ship length, measured by number of rows of containers.
SHMEAN	= Mean draft, in feet.
SHMTI	= Moment of trim by one inch.
T	= Total trim when a container is loaded.
W	= Gross weight of a container being loaded.
D	= Distance from midship to flotation center, positive if C.F is forward of midship, negative otherwise.

BAL1 = Distance from gravity center of aft ballast to midship. Note that if there are more than one aft ballasts, then the gravity center is the center of all ballasts.

BAL2 = Distance from gravity center of forward ballast to midship. See above note.

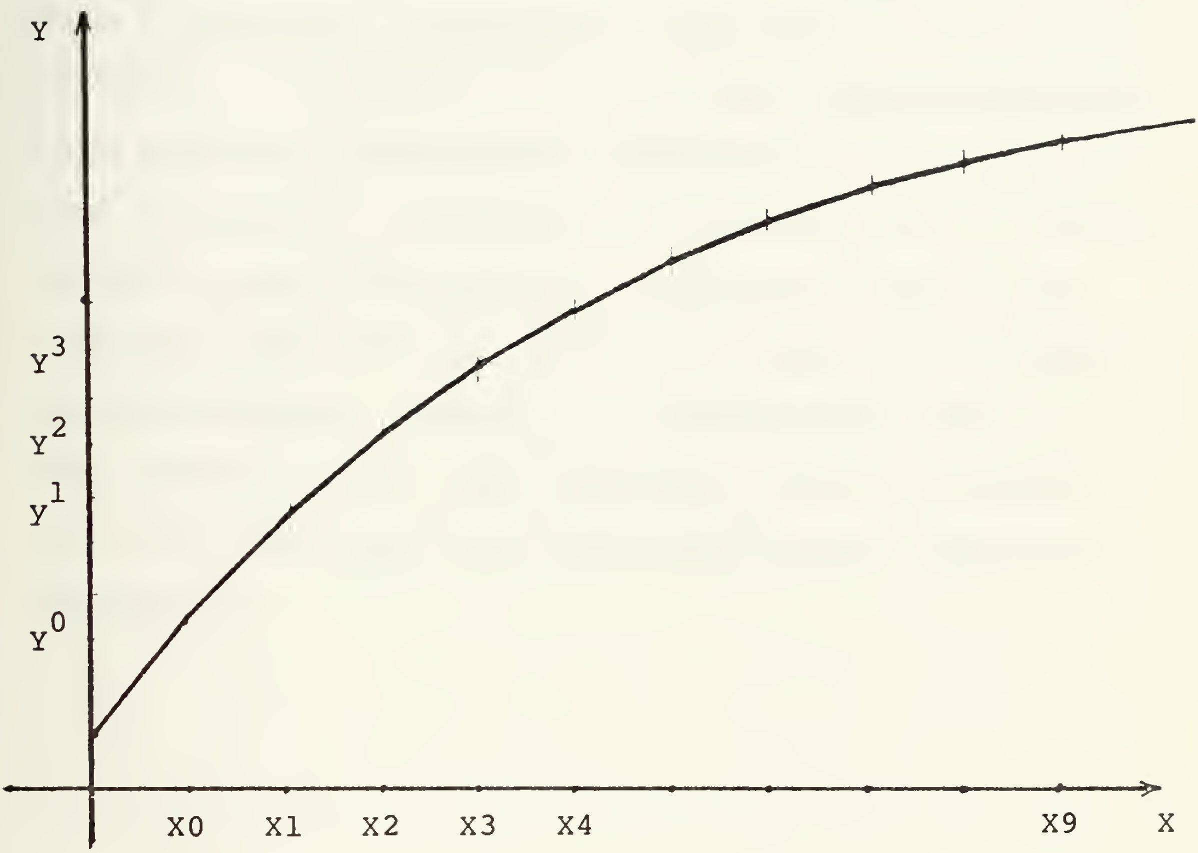

Figure 11: Curve Estimation

VIII. THE MAIN PROGRAM

The main program has been generally depicted by the flow-chart illustrated in Figure 10. Although every statement is important, no attempt is made here to explain each statement. A complete list of variable names is attached in Appendix B, and some brief explanations are integrated into the program to describe its main functions. A numeric example in the next section is used as an illustration. A careful observation of results will help to understand the main program. However, it is recommended that the main program be read both before and after the illustration. It also should be checked during each computation explanation.

IX. ILLUSTRATION

Here is an example which is somewhat close to reality. Data for a C.B-I cargo vessel is used and we suppose that the ship is making a route from LOS ANGELES to SAN FRANCISCO, TOKYO, HONG KONG, SAIGON and then return to LOS ANGELES. There are five ports, NP=5, and the ports are numbered in Figure 12.

It is also supposed that containers are being loaded on the ship at San Francisco, thus, the number of loading port is 2,NLOADP = 2, and containers to SAIGON will be loaded first because there are no containers destined to Los Angeles. The ship can handle 8 columns, and 6 tiers of containers (4 tiers under the main deck). There are totally 2640 addresses but only 946 containers can be loaded. The other addresses are permanently occupied by ship objects. The data mentioned above are read by statement 004.

The total number of rows (equals 55 in this case) are divided into 9 holds. For this example the numbers of rows in the holds are: 9,2,6,2,12,2,6,2,8. Note that these figures can be rearranged, i.e., any number can be zero or any two or more holds can be combined into one hold for stowing one type of cargo. These data are read by statement 005 with format (10I5).

All data related to individual containers (including dummy containers) are read next by statement 007. These

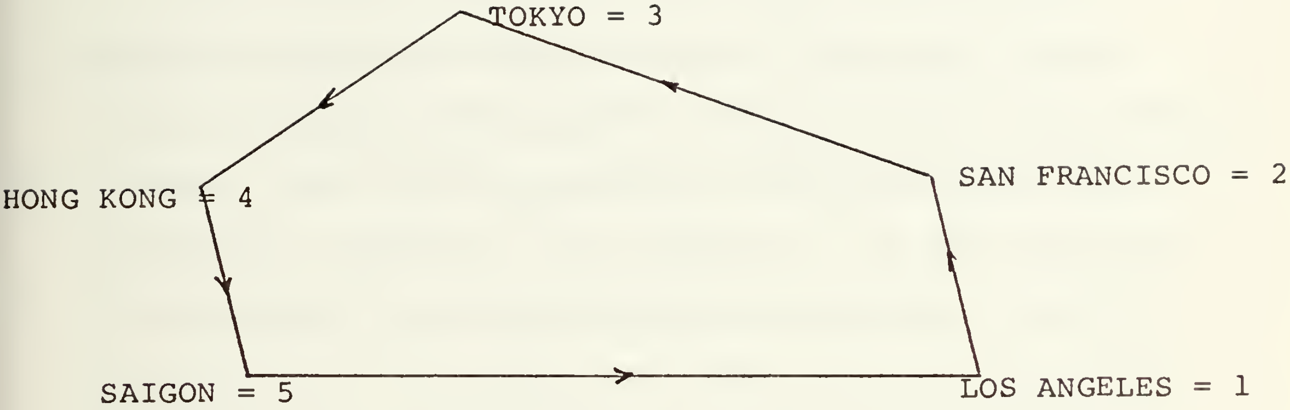

Figure 12: Illustrating Voyage

data are punched on a card, format (I10,3I5,F10.3,I10,2I5). For dummy containers and containers which have been already loaded, addresses in row, column, and tier must be specified.

Next, ship data, (displacement, aft-draft, forward draft, ship length by containers, container length in feet, position of flotation center, position of ballast gravity centers, and coordinates of points on the draft and MTI curves), are read.

Not much is necessary to say about "CALL SORT", Initialization, and Registration of addresses, except what we mean by LOG(JC,JR,JT). Suppose that a container(I) is being sent from Los Angeles to Hong-Kong; its port of destination IPARR(I)=4, see Figure 12. At San Francisco, this container has been already been labeled, and also suppose that it is stowed at column JC, row JR, tier JT. Keep in mind that the location LOG(JC,JR,JT) has been occupied by a container to Hong-Kong which is the <u>third</u> port on the route, relative to loading port, San Francisco. In the process of registration, this relative order is needed so that overstow can be prevented. The absolute, unchanged order IPARR(I) of the container is used to compute the relative order; see statements 026,027,028. Note that any dummy container has that relative order equal to NP (latest call port) so that any real container can be stowed over it.

The first computation is to determine the address of the center column. Columns of containers are assigned

from the left most and from the right most to the center-line. For a maximum of 8 columns the sequential column address is: 8,1,7,2,6,3,5,4. That means the right most column, 8, then the left most column, 1, are assigned first. The last column to be stowed is column-4, and we have to determine this number, MAC, before the main program can call subroutine POST. Depending on whether MAXCOL is odd or even, then:

MAC = (MAXCOL + 1)/2

or MAC = MAXCOL/2 (8/2 = 4, for this example.)

In the grouping process, there is no difficulty to group containers by cargo types. Type-1 cargo containers are considered first. Any container with ITYPE(I) not equal to 1 will be dropped out, and so on. However, it would be a little more complicated to group containers by order of port calls. We can not use IPARR(I) because this variable gives the absolute, unchanged value assigned to each port. What we need is the relative order with respect to the loading port. We start by considering containers of the latest call port. The variable K, the relative order of considered port, and then NARRP, the permanent number assigned to the considered port, are determined and computed. If IPARR(I) is not equal to NARRP, then the container will be dropped out of the grouping process. Statements 034 and 035 compute K and NARRP. The variable K has the sequential values: 5,4,3, and 2, because for the loading port NLOADP = 2, NARRP has the sequential values: 1,5,4, and 3. In this case port-1 is the latest call port.

After all carried containers have been selected and listed on the manifest, the new containers are then assigned. First, the address to the lower-right most aft corner is offered. For this example it is (8,1,1). The address is examined and, in this case, is pre-occupied by ship configuration. The next address is then offered and checked; the step from one address to the next has been explained previously. Actually, the first acceptable address is (7,4,2). See computer print-out page 58.

Based on the order that has been determined by computation, the addresses and related data of all containers destined to port-1, port-5, port-4, port-3 (in that order) are printed. There are no containers from San Francisco to Los Angeles here, therefore, only the headlines are printed.

The last part of the print-out is a summary. First, the boundary of each hold is determined; each container which is in an unacceptable hold, is listed. Sometimes, depending on the nature of the cargo, "sharing" can be tolerated. If it is not tolerated, decisions to relocate or drop-out the containers must be reached before containers are actually loaded.

All addresses and containers are also investigated. Any container which has not been assigned an address, or any address which has not been occupied, are listed. Along with an unoccupied address is the relative order

of the POD of the container which is stowed at the lowest location of the stack on deck. There are addresses un-occupied because there are containers required to be stowed on deck. These containers are for a POD whose relative order is high, therefore, the common containers of other ports can not be used to fill those "lower holes". Again, human interpretation is necessary. In this example, newly loaded common cargo containers destined to Saigon (port-5) which have been assigned addresses somewhere in the same hold should be re-assigned to those unoccupied addresses, and there will be no overstow.

Data related to the containers in the example have been generated by a random number process based on assumption that a certain percent of containers are of type-I, (I = 1,9) and a certain percent of containers from a port-J are sent to a port-K. (K = 1,5; K ≠ J). Certainly overstow depends on the number of containers required to be stowed on deck. With 4%, it is likely that about 1% might be overstowed without manual adjustment.

In the last part of the printout summary are the results related to ship's trim. Note that the weight of water used to balance the ship must be smaller than the capacities of the involved ballasts. This figure is used to identify whether the load plan is feasible. If it is not acceptable, then manual corrections are needed.

For complete results, see the computer printout.

X. FEASIBILITY OF THE MODEL AND RECOMMENDATIONS FOR USE

The model was developed through a heuristic approach, and many assumptions had to be made. As a result, the model's overall capacities are subject to some limitations. The heuristic approach does not always yield an optimal solution. The model assumes that containers are of a single size.

The model does not depend on ship form and ship objects, however, an assumption has been made about the vertical direct accessibility to any address on board. This means that if only one stack of containers under the main deck is to be unloaded, then all containers on the deck, over the hatch, must be removed. In this case, the solution reached may become less meaningful as far as overstow is concerned. However, this problem could be accommodated with multiple-removable-container-sized-auxiliary hatches as shown in Figure 13.

The model is not 100% computerized. Due to a variety of regulations requiring separation of labeled cargo, a ship loaded with all nine types of cargo might not have enough separate holds for each type of cargo; or in some cases, a hold reserved for a specific type of cargo is full. Manual adjustment are also needed in the cases where there is overstow which the program cannot avoid, or in the cases where ship trim, stability, or list is unacceptable.

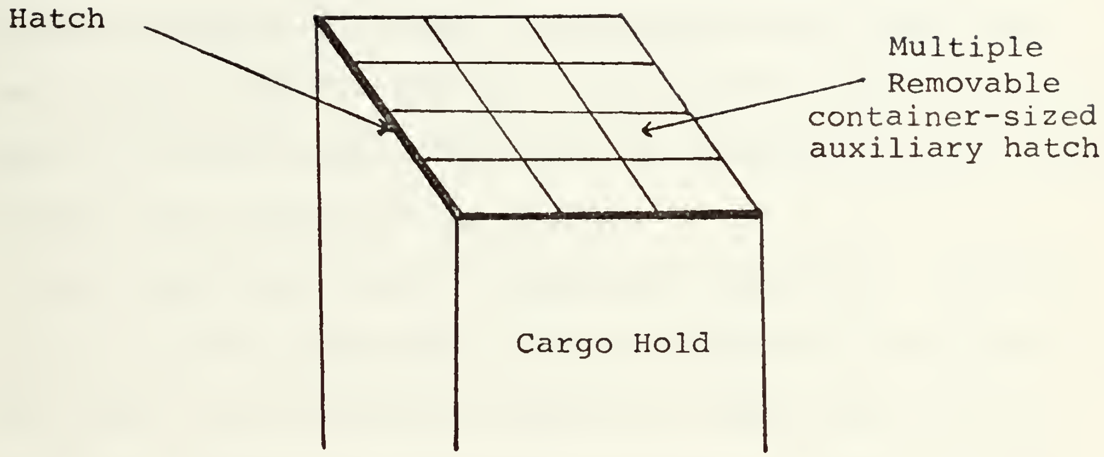

Figure 13: Specially Designed Hatch.

Changing the locations of some container stacks is not very difficult with data available from the computer printout.

The model only shows where containers should be stowed, it does not point out which stack of containers should be loaded first and which one second, etc. If we follow the order printed, the ship might be sunk in port. The loading officer should load stacks of containers in a way such that the ship stay afloat after any container is loaded.

The model can be used in the pre-loading stage. Containers should be arranged in the marshalling area such that they are easy to access. A good solution is to arrange them in the same way as they will be stowed on board, except in each stack the order is reverse.

The last point here is completely technical. To make the model more applicable, all data related to the ship and the voyage can be stored on tape or a data cell, but data related to containers should be punched on cards. Output related to each carried container is needed as input for next loading port, therefore, an extra card output is necessary.

XI. IMPLICATION FOR FURTHER STUDY

A. TESTING AND ANALYSIS

The model has been used with a variety of different data, and results were acceptable. However, the model should be further tested with greater ranges of data by changing the ship, the route, and the generating program, the number of port calls, total number of containers to be loaded, ship characteristics, percentage of labeled cargo, percentage of cargo to each port, etc. Using these variables as independent variables, the model can be tested to provide dependent variables such as number of containers overstowed, number of addresses which must be re-considered, and the number of cases where ship trim is unadjustable. The results could be analyzed by multi-variable statistics in order to draw firm conclusions about the feasibility of the model. The loading program itself requires almost 3 minutes CPU time on an IBM360/67, therefore the process of testing which includes data generating, loading, and analysis, will be costly and time-consuming.

B. MODEL EXPANDING

Only the trim computation has been included in the model. Ship list and stability have been neglected based on the belief that these effects are generally not a problem. Another subroutine should be developed and added to the program, at least for testing and assuring the feasibility of the solution,

The program can be modified to take into account the effect of the hatches on overstow. This development would lead to more realistic solutions.

Like celestial navigation, which provides a better and more accurate position from an estimated position, the model can be developed such that the result after the first loading attempt can be revised and used for the second attempt, etc. As seen in the illustration, the summary has included assignments that must be reconsidered and a number of containers that have not been loaded. The model can be revised such that the program will "automatically" take these considerations into account, reassign some addresses to some containers, and repeat the procedure until an acceptable solution is reached.

The concept of containerization has been in existance for quite some time, but is still an area requiring quantitative research. The model here and its proposed applications are no exception to this.

APPENDIX A

BASIC RULES FOR STORAGE OF CARGO

Type-1: <u>EXPLOSIVES</u>

Must not be stowed with any other labels.

Type-2: <u>INFLAMMABLE COMPRESSED GAS (RED GAS)</u>

Must be stowed on deck.

Cannot be stowed over a red label hatch.

Must be 25 feet from any other hazardous cargo.

Must have the deck house between it and explosives.

Type-3: <u>FLAMMABLE LIQUIDS (RED LABEL)</u>

Must not be stowed in the same hatch with inflammable solids, oxidizing materials, corrosive liquids, poisons, or cotton.

Must not be stowed in the same hold over non-inflammable compressed gases.

Many red label items require between deck storage, therefore no red label is to be stowed in a lower hold or deep tank without checking the regulations.

Must have a full hatch or midship house intervene between it and explosives.

Type-4: <u>INFLAMMABLE SOLIDS/OXIDIZING MATERIAL (YELLOW LABEL)</u>

Must not be stowed in the same hold or compartment as red label, corrosive liquids, poisons, or cotton.

Must no be stowed in the same compartment over non-inflammable compressed gases.

Must have a full hatch or midship house intervene between it and explosives.

Type-5: CORROSIVE LIQUIDS (WHITE LABEL)

Some are permitted under deck storage. General policy is to stow on deck at all times.

Must not be stowed adjacent to or over any poisonous articles or hazardous items.

Must not be stowed on the square of the hatch.

Must have a full hatch or midship house intervene between it and explosives.

Type-6: NON-INFLAMMABLE GASES (GREEN LABEL)

Must not be stowed with explosives.

Must not be over stowed with corrosive liquids, inflammable solids, oxidizing material, poisons, or hazardous articles.

Type-7: POISONOUS ARTICLES (BLUE LABEL)

Must not be stowed in the same compartment with explosives, inflammable liquids, inflammable solids, refrigerated cargo, or cotton.

Must not be stowed adjacent to corrosive liquids.

Must not be stowed over compressed gases.

Type-8: HAZARDOUS ARTICLES

Must not be stowed in any compartment with explosives.

Type-9: COMMON CARGO

Can be stowed any place.

APPENDIX B

LIST OF VARIABLE NAMES USED IN COMPUTER PROGRAM

A = Container position and equals to row address.

BAL1 = Distance from gravity center of aft ballasts to midship.

BAL2 = Distance from gravity center of forward ballasts to midship.

CL = Container length, in feet.

D = Distance from midship to flotation center, positive if CF is forward of midship, negative otherwise.

DIFF = Difference of mean draft after a container is loaded.

DISP = Displacement.

DRAAFT = Aft draft.

DRAFWD = Forward draft.

ICOL(I) = Column address of container I.

IPDEP(I)= Number assigned to a port where the container was loaded.

IPARR(I)= Number assigned to a port where the containter is destined.

IROW(I) = Container row address

ISER(I) = Container serial number.

ITIER(I)= Container tier address

ITYPE(I)= Number assigned to the type of cargo stuffed inside the container.

JC = Column address under processing.

JR = Row address under processing.

JT = Tier address under processing.

JL = First tier address on deck.

K = Relative order of a port under processing.

KRORIG = Maximum row address of a hold.

L = Index assigned to a hold where type-L cargo is stowed.

LOG = Address characteristics, zero denotes unoccupied address.

MAC = Midship column address

MAXCOL = Maximum value of column address

MAXROW(L) = Number of rows in the hold L.

MLOWER = Maximum value of tier address, on deck.

MTIER = Maximum value of tier address.

NCONT = Total number of possible addresses.

NARRP = Number assigned to the port under processing.

NLOADP = Number assigned to the port where containers are being loaded.

NP = Number of ports on the route.

SHLGTH = Overall ship length, measured by number of rows of containers.

SHMEAN = Mean draft, in feet.

SHMTI = Moment trim by one inch.

T = Total trim when a container is loaded.

W = Gross weight of a container being loaded.

WEIGHT(I) = Gross weight of container I.

WATER = Water added in ballasting process.

MANIFEST OF CARGO CONTAINERS TO PORT NO.1

ORDER OF LOADING PORT ON THE ROUTE: 2

CARGO TYPE 1

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 2

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 3

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 4

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 5

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 6

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 7

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 8

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

CARGO TYPE 9

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

MANIFEST OF CARGO CONTAINERS TO PORT NO.5

ORDER OF LOADING PORT ON THE ROUTE: 2

CARGO TYPE 1

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100459	1	5	1	9.349	7	8	2	CARRIED CONTAINER
100656	1	5	1	9.135	7	8	3	CARRIED CONTAINER
100466	1	5	1	8.818	7	8	4	CARRIED CONTAINER
100902	1	5	1	8.307	7	8	5	CARRIED CONTAINER
100670	1	5	1	7.886	7	8	6	CARRIED CONTAINER
100562	1	5	1	6.602	8	8	2	CARRIED CONTAINER
100724	1	5	1	5.117	8	8	3	CARRIED CONTAINER
100189	1	5	1	4.991	8	8	4	CARRIED CONTAINER
100204	1	5	1	3.187	8	8	5	CARRIED CONTAINER
100633	1	5	1	2.907	8	8	6	CARRIED CONTAINER
100785	1	5	1	2.900	9	8	2	CARRIED CONTAINER
100172	1	5	1	2.193	9	8	3	CARRIED CONTAINER
100489	1	5	1	2.069	9	8	4	CARRIED CONTAINER
100447	1	5	1	1.600	9	8	5	CARRIED CONTAINER
100230	1	5	1	1.280	9	8	6	CARRIED CONTAINER
200009	2	5	1	9.687	7	4	2	
200046	2	5	1	8.732	7	4	3	
200029	2	5	1	8.682	7	4	4	
200061	2	5	1	7.884	7	4	5	
200157	2	5	1	4.769	7	4	6	
200158	2	5	1	3.992	8	4	2	
200141	2	5	1	3.987	8	4	3	
200069	2	5	1	3.597	8	4	4	
200060	2	5	1	2.238	8	4	5	
200134	2	5	1	1.563	8	4	6	
200011	2	5	1	0.624	9	4	2	
200056	2	5	1	0.564	9	4	3	
200110	2	5	1	0.534	9	4	4	

CARGO TYPE 2

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

100251	1	5	5	2.307	31	8	5	CARRIED CONTAINER
100055	1	5	5	0.926	31	8	6	CARRIED CONTAINER
100709	1	5	5	0.300	30	1	5	CARRIED CONTAINER
200120	2	5	5	8.909	30	4	5	
200089	2	5	5	8.810	30	4	6	
200036	2	5	5	5.264	31	4	5	
200021	2	5	5	4.741	31	4	6	
200130	2	5	5	3.884	46	4	5	

CARGO TYPE 6

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100154	1	5	6	8.485	32	8	1	CARRIED CONTAINER
100046	1	5	6	5.188	32	8	2	CARRIED CONTAINER
100649	1	5	6	3.231	32	8	3	CARRIED CONTAINER
200149	2	5	6	5.820	32	4	1	

CARGO TYPE 7

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100510	1	5	7	9.072	38	8	1	CARRIED CONTAINER
100473	1	5	7	6.615	38	8	2	CARRIED CONTAINER
100064	1	5	7	5.068	38	8	3	CARRIED CONTAINER
100816	1	5	7	3.580	38	8	4	CARRIED CONTAINER
100438	1	5	7	2.477	38	8	5	CARRIED CONTAINER
100623	1	5	7	0.634	38	8	6	CARRIED CONTAINER

CARGO TYPE 8

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100846	1	5	8	7.491	40	8	1	CARRIED CONTAINER
100293	1	5	8	6.863	40	8	2	CARRIED CONTAINER
100212	1	5	8	1.062	40	8	3	CARRIED CONTAINER
100399	1	5	8	0.739	40	8	4	CARRIED CONTAINER

100375	1	5	2	7.835	10	8	5	CARRIED CONTAINER
100746	1	5	2	4.486	10	8	6	CARRIED CONTAINER
100748	1	5	2	2.169	11	8	5	CARRIED CONTAINER
200052	2	5	2	8.268	10	4	5	
200144	2	5	2	6.076	10	4	6	

CARGO TYPE 3

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100184	1	5	3	8.018	16	8	2	CARRIED CONTAINER
100796	1	5	3	7.918	16	8	3	CARRIED CONTAINER
100013	1	5	3	7.360	16	8	4	CARRIED CONTAINER
100133	1	5	3	5.245	16	8	5	CARRIED CONTAINER
100795	1	5	3	3.905	16	8	6	CARRIED CONTAINER
100309	1	5	3	3.275	17	8	2	CARRIED CONTAINER
100294	1	5	3	3.009	17	8	3	CARRIED CONTAINER
100273	1	5	3	1.327	17	8	4	CARRIED CONTAINER
100770	1	5	3	0.883	17	8	5	CARRIED CONTAINER
100669	1	5	3	0.466	17	8	6	CARRIED CONTAINER
200012	2	5	3	7.746	16	4	2	
200068	2	5	3	5.366	16	4	3	

CARGO TYPE 4

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100469	1	5	4	5.004	18	8	2	CARRIED CONTAINER
100676	1	5	4	4.728	18	8	3	CARRIED CONTAINER
100074	1	5	4	4.616	18	8	4	CARRIED CONTAINER

CARGO TYPE 5

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100149	1	5	5	8.603	30	8	5	CARRIED CONTAINER
100639	1	5	5	6.654	30	8	6	CARRIED CONTAINER

200048	2	5	8	5.474	40	5	1	
200139	2	5	8	3.801	40	5	2	
200124	2	5	8	3.731	40	5	3	

CARGO TYPE 9

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100856	1	5	9	9.989	10	8	2	CARRIED CONTAINER
100152	1	5	9	9.948	10	8	3	CARRIED CONTAINER
100105	1	5	9	9.928	10	8	4	CARRIED CONTAINER
100777	1	5	9	9.909	11	8	2	CARRIED CONTAINER
100781	1	5	9	9.903	11	8	3	CARRIED CONTAINER
100576	1	5	9	9.880	11	8	4	CARRIED CONTAINER
100386	1	5	9	9.876	11	8	6	CARRIED CONTAINER
100140	1	5	9	9.750	18	8	5	CARRIED CONTAINER
100613	1	5	9	9.635	18	8	6	CARRIED CONTAINER
100431	1	5	9	9.598	19	8	2	CARRIED CONTAINER
100621	1	5	9	9.582	19	8	3	CARRIED CONTAINER
100647	1	5	9	9.533	19	8	4	CARRIED CONTAINER
100131	1	5	9	9.336	19	8	5	CARRIED CONTAINER
100214	1	5	9	9.182	19	8	6	CARRIED CONTAINER
100159	1	5	9	9.143	30	8	1	CARRIED CONTAINER
100436	1	5	9	9.103	30	8	2	CARRIED CONTAINER
100320	1	5	9	9.088	30	8	3	CARRIED CONTAINER
100151	1	5	9	9.074	30	8	4	CARRIED CONTAINER
100894	1	5	9	9.059	31	8	1	CARRIED CONTAINER
100406	1	5	9	9.025	31	8	2	CARRIED CONTAINER
100432	1	5	9	9.007	31	8	3	CARRIED CONTAINER
100672	1	5	9	8.940	31	8	4	CARRIED CONTAINER
100474	1	5	9	8.854	32	8	4	CARRIED CONTAINER
100924	1	5	9	8.812	32	8	5	CARRIED CONTAINER
100686	1	5	9	8.709	32	8	6	CARRIED CONTAINER
100471	1	5	9	8.649	33	8	1	CARRIED CONTAINER
100328	1	5	9	8.610	33	8	2	CARRIED CONTAINER
100536	1	5	9	8.590	33	8	3	CARRIED CONTAINER
100896	1	5	9	8.480	33	8	4	CARRIED CONTAINER
100552	1	5	9	8.478	33	8	5	CARRIED CONTAINER
100516	1	5	9	8.367	33	8	6	CARRIED CONTAINER

100814	1	5	9	8.260	39	8	1	CARRIED CONTAINER
100735	1	5	9	8.242	39	8	2	CARRIED CONTAINER
100696	1	5	9	8.226	39	8	3	CARRIED CONTAINER
100113	1	5	9	8.044	39	8	4	CARRIED CONTAINER
100449	1	5	9	7.890	39	8	5	CARRIED CONTAINER
100533	1	5	9	7.848	39	8	6	CARRIED CONTAINER
100435	1	5	9	7.702	40	8	5	CARRIED CONTAINER
100080	1	5	9	7.640	40	8	6	CARRIED CONTAINER
100578	1	5	9	7.594	41	8	1	CARRIED CONTAINER
100517	1	5	9	7.428	41	8	2	CARRIED CONTAINER
100926	1	5	9	7.343	41	8	3	CARRIED CONTAINER
100799	1	5	9	7.290	41	8	4	CARRIED CONTAINER
100634	1	5	9	7.218	41	8	5	CARRIED CONTAINER
100740	1	5	9	7.126	41	8	6	CARRIED CONTAINER
100258	1	5	9	7.060	46	8	1	CARRIED CONTAINER
100665	1	5	9	7.037	46	8	2	CARRIED CONTAINER
100506	1	5	9	7.020	46	8	3	CARRIED CONTAINER
100006	1	5	9	6.981	46	8	4	CARRIED CONTAINER
100858	1	5	9	6.903	46	8	5	CARRIED CONTAINER
100530	1	5	9	6.902	46	8	6	CARRIED CONTAINER
100053	1	5	9	6.894	47	8	1	CARRIED CONTAINER
100178	1	5	9	6.664	47	8	2	CARRIED CONTAINER
100122	1	5	9	6.565	47	8	3	CARRIED CONTAINER
100171	1	5	9	6.456	47	8	4	CARRIED CONTAINER
100546	1	5	9	6.354	47	8	5	CARRIED CONTAINER
100584	1	5	9	6.325	47	8	6	CARRIED CONTAINER
100803	1	5	9	6.192	48	8	1	CARRIED CONTAINER
100843	1	5	9	6.122	48	8	2	CARRIED CONTAINER
100019	1	5	9	6.063	48	8	3	CARRIED CONTAINER
100557	1	5	9	6.043	48	8	4	CARRIED CONTAINER
100084	1	5	9	5.970	48	8	5	CARRIED CONTAINER
100121	1	5	9	5.962	48	8	6	CARRIED CONTAINER
100056	1	5	9	5.929	49	8	1	CARRIED CONTAINER
100835	1	5	9	5.926	49	8	2	CARRIED CONTAINER
100028	1	5	9	5.904	49	8	3	CARRIED CONTAINER
100512	1	5	9	5.805	49	8	4	CARRIED CONTAINER
100037	1	5	9	5.803	49	8	5	CARRIED CONTAINER
100041	1	5	9	5.767	49	8	6	CARRIED CONTAINER
100219	1	5	9	5.653	7	1	2	CARRIED CONTAINER
100132	1	5	9	5.584	7	1	3	CARRIED CONTAINER

100059	1	5	9	5.580	7	1	4	CARRIED CONTAINER
100650	1	5	9	5.437	7	1	5	CARRIED CONTAINER
100702	1	5	9	5.433	7	1	6	CARRIED CONTAINER
100217	1	5	9	5.277	8	1	2	CARRIED CONTAINER
100090	1	5	9	5.233	8	1	3	CARRIED CONTAINER
100403	1	5	9	5.178	8	1	4	CARRIED CONTAINER
100177	1	5	9	5.148	8	1	5	CARRIED CONTAINER
100568	1	5	9	5.146	8	1	6	CARRIED CONTAINER
100020	1	5	9	5.102	9	1	2	CARRIED CONTAINER
100166	1	5	9	5.100	9	1	3	CARRIED CONTAINER
100807	1	5	9	4.953	9	1	4	CARRIED CONTAINER
100531	1	5	9	4.860	9	1	5	CARRIED CONTAINER
100540	1	5	9	4.823	9	1	6	CARRIED CONTAINER
100292	1	5	9	4.702	10	1	2	CARRIED CONTAINER
100526	1	5	9	4.692	10	1	3	CARRIED CONTAINER
100285	1	5	9	4.523	10	1	4	CARRIED CONTAINER
100539	1	5	9	4.497	10	1	5	CARRIED CONTAINER
100749	1	5	9	4.495	10	1	6	CARRIED CONTAINER
100004	1	5	9	4.487	11	1	2	CARRIED CONTAINER
100318	1	5	9	4.428	11	1	3	CARRIED CONTAINER
100246	1	5	9	4.371	11	1	4	CARRIED CONTAINER
100600	1	5	9	4.355	11	1	5	CARRIED CONTAINER
100766	1	5	9	4.203	11	1	6	CARRIED CONTAINER
100264	1	5	9	4.190	16	1	2	CARRIED CONTAINER
100737	1	5	9	4.154	16	1	3	CARRIED CONTAINER
100096	1	5	9	4.141	16	1	4	CARRIED CONTAINER
100332	1	5	9	3.972	16	1	5	CARRIED CONTAINER
100002	1	5	9	3.960	16	1	6	CARRIED CONTAINER
100457	1	5	9	3.622	17	1	2	CARRIED CONTAINER
100918	1	5	9	3.620	17	1	3	CARRIED CONTAINER
100235	1	5	9	3.549	17	1	4	CARRIED CONTAINER
100191	1	5	9	3.444	17	1	5	CARRIED CONTAINER
100603	1	5	9	3.430	17	1	6	CARRIED CONTAINER
100496	1	5	9	3.395	18	1	2	CARRIED CONTAINER
100632	1	5	9	3.374	18	1	3	CARRIED CONTAINER
100247	1	5	9	3.337	18	1	4	CARRIED CONTAINER
100005	1	5	9	3.302	18	1	5	CARRIED CONTAINER
100416	1	5	9	3.225	18	1	6	CARRIED CONTAINER
100112	1	5	9	3.199	19	1	2	CARRIED CONTAINER
100919	1	5	9	3.194	19	1	3	CARRIED CONTAINER

100683	1	5	9	3.135	19	1	4	CARRIED CONTAINER
100664	1	5	9	3.112	19	1	5	CARRIED CONTAINER
100763	1	5	9	3.071	19	1	6	CARRIED CONTAINER
100081	1	5	9	2.970	30	1	1	CARRIED CONTAINER
100065	1	5	9	2.928	30	1	2	CARRIED CONTAINER
100395	1	5	9	2.918	30	1	3	CARRIED CONTAINER
100100	1	5	9	2.861	30	1	4	CARRIED CONTAINER
100260	1	5	9	2.846	30	1	6	CARRIED CONTAINER
100120	1	5	9	2.723	31	1	1	CARRIED CONTAINER
100134	1	5	9	2.718	31	1	2	CARRIED CONTAINER
100534	1	5	9	2.629	31	1	3	CARRIED CONTAINER
100286	1	5	9	2.577	31	1	4	CARRIED CONTAINER
100817	1	5	9	2.472	31	1	5	CARRIED CONTAINER
100058	1	5	9	2.408	31	1	6	CARRIED CONTAINER
100605	1	5	9	2.363	32	1	1	CARRIED CONTAINER
100099	1	5	9	2.333	32	1	2	CARRIED CONTAINER
100805	1	5	9	2.319	32	1	3	CARRIED CONTAINER
100220	1	5	9	2.214	32	1	4	CARRIED CONTAINER
100838	1	5	9	2.205	32	1	5	CARRIED CONTAINER
100380	1	5	9	2.008	32	1	6	CARRIED CONTAINER
100738	1	5	9	1.992	33	1	1	CARRIED CONTAINER
100168	1	5	9	1.955	33	1	2	CARRIED CONTAINER
100493	1	5	9	1.887	33	1	3	CARRIED CONTAINER
100115	1	5	9	1.804	33	1	4	CARRIED CONTAINER
100793	1	5	9	1.763	33	1	5	CARRIED CONTAINER
100678	1	5	9	1.758	33	1	6	CARRIED CONTAINER
100304	1	5	9	1.754	38	1	1	CARRIED CONTAINER
100561	1	5	9	1.541	38	1	2	CARRIED CONTAINER
100711	1	5	9	1.526	38	1	3	CARRIED CONTAINER
100645	1	5	9	1.525	38	1	4	CARRIED CONTAINER
100190	1	5	9	1.522	38	1	5	CARRIED CONTAINER
100505	1	5	9	1.447	38	1	6	CARRIED CONTAINER
100809	1	5	9	1.444	39	1	1	CARRIED CONTAINER
100257	1	5	9	1.441	39	1	2	CARRIED CONTAINER
100641	1	5	9	1.414	39	1	3	CARRIED CONTAINER
100934	1	5	9	1.359	39	1	4	CARRIED CONTAINER
100867	1	5	9	1.322	39	1	5	CARRIED CONTAINER
100127	1	5	9	1.315	39	1	6	CARRIED CONTAINER
100504	1	5	9	1.277	40	1	1	CARRIED CONTAINER
100336	1	5	9	1.272	40	1	2	CARRIED CONTAINER

100401	1	5	9	1.235	40	1	3	CARRIED CONTAINER
100272	1	5	9	1.106	40	1	4	CARRIED CONTAINER
100848	1	5	9	1.042	40	1	5	CARRIED CONTAINER
100514	1	5	9	1.035	40	1	6	CARRIED CONTAINER
100299	1	5	9	0.975	41	1	1	CARRIED CONTAINER
100086	1	5	9	0.938	41	1	2	CARRIED CONTAINER
100812	1	5	9	0.782	41	1	3	CARRIED CONTAINER
100111	1	5	9	0.775	41	1	4	CARRIED CONTAINER
100873	1	5	9	0.755	41	1	5	CARRIED CONTAINER
100716	1	5	9	0.745	41	1	6	CARRIED CONTAINER
100378	1	5	9	0.595	46	1	1	CARRIED CONTAINER
100023	1	5	9	0.569	46	1	2	CARRIED CONTAINER
100916	1	5	9	0.401	46	1	3	CARRIED CONTAINER
100486	1	5	9	0.387	46	1	4	CARRIED CONTAINER
100635	1	5	9	0.378	46	1	5	CARRIED CONTAINER
100463	1	5	9	0.355	46	1	6	CARRIED CONTAINER
100325	1	5	9	0.300	47	1	1	CARRIED CONTAINER
100244	1	5	9	0.300	47	1	2	CARRIED CONTAINER
100756	1	5	9	0.300	47	1	3	CARRIED CONTAINER
100579	1	5	9	0.300	47	1	4	CARRIED CONTAINER
100878	1	5	9	0.300	47	1	5	CARRIED CONTAINER
100695	1	5	9	0.300	47	1	6	CARRIED CONTAINER
200111	2	5	9	9.925	38	5	1	
200122	2	5	9	9.786	38	5	2	
200162	2	5	9	9.647	38	5	3	
200044	2	5	9	9.567	38	5	4	
200143	2	5	9	9.199	38	5	5	
200106	2	5	9	9.117	38	5	6	
200051	2	5	9	9.011	39	5	1	
200159	2	5	9	9.007	39	5	2	
200032	2	5	9	8.729	39	5	3	
200005	2	5	9	8.683	39	5	4	
200109	2	5	9	8.668	39	5	5	
200150	2	5	9	8.584	39	5	6	
200064	2	5	9	8.339	40	5	4	
200018	2	5	9	8.253	40	5	5	
200034	2	5	9	8.004	40	5	6	
200016	2	5	9	7.989	41	5	1	
200019	2	5	9	7.981	41	5	2	
200067	2	5	9	7.841	41	5	3	

200093	2	5	9	7.805	41	5	4
200097	2	5	9	7.699	41	5	5
200155	2	5	9	7.323	41	5	6
200053	2	5	9	7.277	46	5	1
200127	2	5	9	7.255	46	5	2
200121	2	5	9	7.126	46	5	3
200116	2	5	9	7.088	46	5	4
200125	2	5	9	6.875	46	5	5
200100	2	5	9	6.831	46	5	6
200104	2	5	9	6.757	47	5	1
200045	2	5	9	6.718	47	5	2
200092	2	5	9	6.611	47	5	3
200161	2	5	9	6.539	47	5	4
200154	2	5	9	6.479	47	5	5
200102	2	5	9	6.183	47	5	6
200091	2	5	9	6.172	48	5	1
200160	2	5	9	6.164	48	5	2
200033	2	5	9	5.951	48	5	3
200024	2	5	9	5.560	48	5	4
200039	2	5	9	5.395	48	5	5
200152	2	5	9	5.317	48	5	6
200105	2	5	9	5.276	49	5	1
200058	2	5	9	5.243	49	5	2
200131	2	5	9	4.715	49	5	3
200001	2	5	9	4.558	49	5	4
200078	2	5	9	4.515	49	5	5
200062	2	5	9	4.380	49	5	6
200057	2	5	9	4.379	9	4	5
200163	2	5	9	4.344	9	4	6
200020	2	5	9	4.307	10	4	2
200031	2	5	9	4.178	10	4	3
200129	2	5	9	3.971	10	4	4
200002	2	5	9	3.956	11	4	2
200147	2	5	9	3.915	11	4	3
200035	2	5	9	3.898	11	4	4
200041	2	5	9	3.721	11	4	5
200025	2	5	9	3.062	11	4	6
200140	2	5	9	3.058	16	4	4
200165	2	5	9	2.983	16	4	5
200071	2	5	9	2.701	16	4	6

200119	2	5	9	2.529	17	4	2
200070	2	5	9	2.131	17	4	3
200108	2	5	9	2.095	17	4	4
200026	2	5	9	1.982	17	4	5
200042	2	5	9	1.760	17	4	6
200113	2	5	9	1.708	18	4	2
200135	2	5	9	1.648	18	4	3
200153	2	5	9	1.348	18	4	4
200049	2	5	9	1.187	18	4	5
200074	2	5	9	0.933	18	4	6
200038	2	5	9	0.922	19	4	2
200151	2	5	9	0.433	19	4	3
200075	2	5	9	0.300	19	4	4

MANIFEST OF CARGO CONTAINERS TO PORT NO.4

ORDER OF LOADING PORT ON THE ROUTE: 2

CARGO TYPE 1

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100761	1	4	1	9.808	7	7	2	CARRIED CONTAINER
100884	1	4	1	9.230	7	7	3	CARRIED CONTAINER
100169	1	4	1	8.906	7	7	4	CARRIED CONTAINER
100119	1	4	1	8.547	7	7	5	CARRIED CONTAINER
100765	1	4	1	8.525	7	7	6	CARRIED CONTAINER
100657	1	4	1	7.646	8	7	2	CARRIED CONTAINER
100103	1	4	1	7.603	8	7	3	CARRIED CONTAINER
100545	1	4	1	7.415	8	7	4	CARRIED CONTAINER
100016	1	4	1	6.276	8	7	5	CARRIED CONTAINER
100668	1	4	1	5.963	8	7	6	CARRIED CONTAINER
100319	1	4	1	5.500	9	7	2	CARRIED CONTAINER
100444	1	4	1	5.083	9	7	3	CARRIED CONTAINER
100001	1	4	1	4.718	9	7	4	CARRIED CONTAINER
100879	1	4	1	4.672	9	7	5	CARRIED CONTAINER
100241	1	4	1	4.169	9	7	6	CARRIED CONTAINER
100507	1	4	1	3.936	7	2	2	CARRIED CONTAINER
100911	1	4	1	3.558	7	2	3	CARRIED CONTAINER
100396	1	4	1	3.352	7	2	4	CARRIED CONTAINER
100331	1	4	1	2.562	7	2	5	CARRIED CONTAINER
100565	1	4	1	2.121	7	2	6	CARRIED CONTAINER
100421	1	4	1	1.248	8	2	2	CARRIED CONTAINER
100357	1	4	1	0.883	8	2	3	CARRIED CONTAINER
100662	1	4	1	0.846	8	2	4	CARRIED CONTAINER
100813	1	4	1	0.713	8	2	5	CARRIED CONTAINER
100208	1	4	1	0.300	8	2	6	CARRIED CONTAINER
200146	2	4	1	5.655	46	4	6	
200083	2	4	1	3.736	47	4	1	
200050	2	4	1	3.235	47	4	2	
200145	2	4	1	2.320	47	4	3	
200007	2	4	1	1.943	47	4	4	

CARGO TYPE 2

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

100525	1	4	2	9.975	10	7	5	CARRIED CONTAINER
100404	1	4	2	4.820	10	7	6	CARRIED CONTAINER
100135	1	4	2	3.071	11	7	5	CARRIED CONTAINER
100044	1	4	2	2.464	11	7	6	CARRIED CONTAINER
100786	1	4	2	0.917	10	2	5	CARRIED CONTAINER
100923	1	4	2,	0.300	10	2	6	CARRIED CONTAINER

CARGO TYPE 3

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100243	1	4	3	8.914	16	7	2	CARRIED CONTAINER
100608	1	4	3	7.911	16	7	3	CARRIED CONTAINER
100871	1	4	3	6.139	16	7	4	CARRIED CONTAINER
100704	1	4	3	4.378	16	7	5	CARRIED CONTAINER
100925	1	4	3	2.055	16	7	6	CARRIED CONTAINER
100102	1	4	3	1.576	17	7	2	CARRIED CONTAINER
100834	1	4	3	0.318	17	7	3	CARRIED CONTAINER
200028	2	4	3	5.483	47	4	5	

CARGO TYPE 4

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100831	1	4	4	7.916	18	7	2	CARRIED CONTAINER
100076	1	4	4	6.263	18	7	3	CARRIED CONTAINER
100827	1	4	4	3.754	18	7	4	CARRIED CONTAINER
100368	1	4	4	3.382	18	7	5	CARRIED CONTAINER
100889	1	4	4	1.524	18	7	6	CARRIED CONTAINER
100845	1	4	4	0.979	19	7	2	CARRIED CONTAINER
200090	2	4	4	7.567	19	4	5	

CARGO TYPE 5

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100366	1	4	5	9.960	30	7	5	CARRIED CONTAINER

100363	1	4	5	8.031	30	7	6	CARRIED CONTAINER
100092	1	4	5	4.939	31	7	5	CARRIED CONTAINER
100049	1	4	5	4.185	31	7	6	CARRIED CONTAINER
100611	1	4	5	1.602	30	2	5	CARRIED CONTAINER
100719	1	4	5	0.455	30	2	6	CARRIED CONTAINER
200040	2	4	5	9.382	47	4	6	

CARGO TYPE 6

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100685	1	4	6	9.926	32	7	1	CARRIED CONTAINER
100464	1	4	6	8.714	32	7	2	CARRIED CONTAINER
100370	1	4	6	7.842	32	7	3	CARRIED CONTAINER
100875	1	4	6	6.748	32	7	4	CARRIED CONTAINER
100442	1	4	6	1.656	32	7	5	CARRIED CONTAINER
200030	2	4	6	1.354	32	4	2	

CARGO TYPE 7

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100653	1	4	7	8.908	38	7	1	CARRIED CONTAINER
100627	1	4	7	7.363	38	7	2	CARRIED CONTAINER
100072	1	4	7	4.699	38	7	3	CARRIED CONTAINER
100025	1	4	7	2.676	38	7	4	CARRIED CONTAINER

CARGO TYPE 8

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100478	1	4	8	7.752	40	7	1	CARRIED CONTAINER
100521	1	4	8	5.666	40	7	2	CARRIED CONTAINER
100638	1	4	8	5.249	40	7	3	CARRIED CONTAINER
200066	2	4	8	6.705	40	4	1	
200112	2	4	8	6.423	40	4	2	
200128	2	4	8	2.086	40	4	3	

200164 2 4 8 1.853 40 4 4

CARGO TYPE 9

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100087	1	4	9	9.917	48	1	1	CARRIED CONTAINER
100618	1	4	9	9.908	48	1	2	CARRIED CONTAINER
100722	1	4	9	9.880	48	1	3	CARRIED CONTAINER
100567	1	4	9	9.855	48	1	4	CARRIED CONTAINER
100480	1	4	9	9.819	48	1	5	CARRIED CONTAINER
100232	1	4	9	9.642	48	1	6	CARRIED CONTAINER
100588	1	4	9	9.626	49	1	1	CARRIED CONTAINER
100007	1	4	9	9.594	49	1	2	CARRIED CONTAINER
100316	1	4	9	9.567	49	1	3	CARRIED CONTAINER
100130	1	4	9	9.463	49	1	4	CARRIED CONTAINER
100723	1	4	9	9.399	49	1	5	CARRIED CONTAINER
100379	1	4	9	9.371	49	1	6	CARRIED CONTAINER
100452	1	4	9	9.323	10	7	2	CARRIED CONTAINER
100798	1	4	9	9.273	10	7	3	CARRIED CONTAINER
100498	1	4	9	9.272	10	7	4	CARRIED CONTAINER
100326	1	4	9	8.888	11	7	2	CARRIED CONTAINER
100233	1	4	9	8.873	11	7	3	CARRIED CONTAINER
100108	1	4	9	8.858	11	7	4	CARRIED CONTAINER
100445	1	4	9	8.851	17	7	4	CARRIED CONTAINER
100731	1	4	9	8.838	17	7	5	CARRIED CONTAINER
100566	1	4	9	8.816	17	7	6	CARRIED CONTAINER
100792	1	4	9	8.663	19	7	3	CARRIED CONTAINER
100855	1	4	9	8.662	19	7	4	CARRIED CONTAINER
100341	1	4	9	8.645	19	7	5	CARRIED CONTAINER
100352	1	4	9	8.577	19	7	6	CARRIED CONTAINER
100008	1	4	9	8.573	30	7	1	CARRIED CONTAINER
100862	1	4	9	8.527	30	7	2	CARRIED CONTAINER
100068	1	4	9	8.523	30	7	3	CARRIED CONTAINER
100730	1	4	9	8.520	30	7	4	CARRIED CONTAINER
100821	1	4	9	8.433	31	7	1	CARRIED CONTAINER
100024	1	4	9	8.292	31	7	2	CARRIED CONTAINER
100574	1	4	9	8.259	31	7	3	CARRIED CONTAINER
100231	1	4	9	8.205	31	7	4	CARRIED CONTAINER

100239	1	4	9	8.150	32	7	6	CARRIED CONTAINER
100866	1	4	9	8.146	33	7	1	CARRIED CONTAINER
100908	1	4	9	8.138	33	7	2	CARRIED CONTAINER
100802	1	4	9	8.069	33	7	3	CARRIED CONTAINER
100298	1	4	9	8.C64	33	7	4	CARRIED CONTAINER
100779	1	4	9	8.010	33	7	5	CARRIED CONTAINER
100359	1	4	9	7.969	33	7	6	CARRIED CONTAINER
100852	1	4	9	7.678	38	7	5	CARRIED CONTAINER
100354	1	4	9	7.652	38	7	6	CARRIED CONTAINER
100935	1	4	9	7.584	39	7	1	CARRIED CONTAINER
100376	1	4	9	7.553	39	7	2	CARRIED CONTAINER
100143	1	4	9	7.501	39	7	3	CARRIED CONTAINER
100707	1	4	9	7.462	39	7	4	CARRIED CONTAINER
100861	1	4	9	7.437	39	7	5	CARRIED CONTAINER
100499	1	4	9	7.319	39	7	6	CARRIED CONTAINER
100682	1	4	9	7.282	40	7	4	CARRIED CONTAINER
100559	1	4	9	7.201	40	7	5	CARRIED CONTAINER
100125	1	4	9	7.161	40	7	6	CARRIED CONTAINER
100755	1	4	9	7.134	41	7	1	CARRIED CONTAINER
100167	1	4	9	7.032	41	7	2	CARRIED CONTAINER
100322	1	4	9	6.995	41	7	3	CARRIED CONTAINER
100278	1	4	9	6.908	41	7	4	CARRIED CONTAINER
100073	1	4	9	6.850	41	7	5	CARRIED CONTAINER
100186	1	4	9	6.822	41	7	6	CARRIED CONTAINER
100790	1	4	9	6.802	46	7	1	CARRIED CONTAINER
100860	1	4	9	6.739	46	7	2	CARRIED CONTAINER
100586	1	4	9	6.738	46	7	3	CARRIED CONTAINER
100895	1	4	9	6.713	46	7	4	CARRIED CONTAINER
100179	1	4	9	6.682	46	7	5	CARRIED CONTAINER
100158	1	4	9	6.674	46	7	6	CARRIED CONTAINER
100344	1	4	9	6.588	47	7	1	CARRIED CONTAINER
100011	1	4	9	6.509	47	7	2	CARRIED CONTAINER
100437	1	4	9	6.452	47	7	3	CARRIED CONTAINER
100425	1	4	9	6.427	47	7	4	CARRIED CONTAINER
100503	1	4	9	6.416	47	7	5	CARRIED CONTAINER
100185	1	4	9	6.327	47	7	6	CARRIED CONTAINER
100356	1	4	9	6.289	48	7	1	CARRIED CONTAINER
100671	1	4	9	6.260	48	7	2	CARRIED CONTAINER
100175	1	4	9	6.134	48	7	3	CARRIED CONTAINER
100207	1	4	9	6.120	48	7	4	CARRIED CONTAINER

100288	1	4	9	6.110	48	7	5	CARRIED CONTAINER
100157	1	4	9	6.092	48	7	6	CARRIED CONTAINER
100377	1	4	9	6.053	49	7	1	CARRIED CONTAINER
100772	1	4	9	6.052	49	7	2	CARRIED CONTAINER
100593	1	4	9	6.040	49	7	3	CARRIED CONTAINER
100500	1	4	9	6.006	49	7	4	CARRIED CONTAINER
100877	1	4	9	6.001	49	7	6	CARRIED CONTAINER
100297	1	4	9	6.001	49	7	5	CARRIED CONTAINER
100743	1	4	9	5.979	9	2	2	CARRIED CONTAINER
100808	1	4	9	5.967	9	2	3	CARRIED CONTAINER
100753	1	4	9	5.965	9	2	4	CARRIED CONTAINER
100266	1	4	9	5.964	9	2	5	CARRIED CONTAINER
100126	1	4	9	5.954	9	2	6	CARRIED CONTAINER
100898	1	4	9	5.823	10	2	2	CARRIED CONTAINER
100060	1	4	9	5.821	10	2	3	CARRIED CONTAINER
100392	1	4	9	5.768	10	2	4	CARRIED CONTAINER
100554	1	4	9	5.723	11	2	2	CARRIED CONTAINER
100629	1	4	9	5.694	11	2	3	CARRIED CONTAINER
100853	1	4	9	5.592	11	2	4	CARRIED CONTAINER
100528	1	4	9	5.521	11	2	5	CARRIED CONTAINER
100306	1	4	9	5.461	11	2	6	CARRIED CONTAINER
100788	1	4	9	5.421	16	2	2	CARRIED CONTAINER
100646	1	4	9	5.388	16	2	3	CARRIED CONTAINER
100907	1	4	9	5.387	16	2	4	CARRIED CONTAINER
100277	1	4	9	5.287	16	2	5	CARRIED CONTAINER
100405	1	4	9	5.244	16	2	6	CARRIED CONTAINER
100888	1	4	9	5.186	17	2	2	CARRIED CONTAINER
100384	1	4	9	5.174	17	2	3	CARRIED CONTAINER
100915	1	4	9	5.084	17	2	4	CARRIED CONTAINER
100057	1	4	9	5.082	17	2	5	CARRIED CONTAINER
100617	1	4	9	5.071	17	2	6	CARRIED CONTAINER
100183	1	4	9	5.002	18	2	2	CARRIED CONTAINER
100606	1	4	9	4.973	18	2	3	CARRIED CONTAINER
100050	1	4	9	4.883	18	2	4	CARRIED CONTAINER
100482	1	4	9	4.870	18	2	5	CARRIED CONTAINER
100450	1	4	9	4.842	18	2	6	CARRIED CONTAINER
100745	1	4	9	4.841	19	2	2	CARRIED CONTAINER
100250	1	4	9	4.819	19	2	3	CARRIED CONTAINER
100372	1	4	9	4.815	19	2	4	CARRIED CONTAINER
100031	1	4	9	4.740	19	2	6	CARRIED CONTAINER

100754	1	4	9	4.740	19	2	5	CARRIED CONTAINER
100211	1	4	9	4.735	30	2	1	CARRIED CONTAINER
100003	1	4	9	4.649	30	2	2	CARRIED CONTAINER
100035	1	4	9	4.589	30	2	3	CARRIED CONTAINER
100052	1	4	9	4.565	30	2	4	CARRIED CONTAINER
100373	1	4	9	4.513	31	2	1	CARRIED CONTAINER
100136	1	4	9	4.500	31	2	2	CARRIED CONTAINER
100227	1	4	9	4.317	31	2	3	CARRIED CONTAINER
100238	1	4	9	4.308	31	2	4	CARRIED CONTAINER
100229	1	4	9	4.267	31	2	5	CARRIED CONTAINER
100271	1	4	9	4.168	31	2	6	CARRIED CONTAINER
100427	1	4	9	4.012	32	2	1	CARRIED CONTAINER
100582	1	4	9	3.977	32	2	2	CARRIED CONTAINER
100210	1	4	9	3.943	32	2	3	CARRIED CONTAINER
100757	1	4	9	3.929	32	2	4	CARRIED CONTAINER
100800	1	4	9	3.790	32	2	5	CARRIED CONTAINER
100599	1	4	9	3.789	32	2	6	CARRIED CONTAINER
100305	1	4	9	3.779	33	2	1	CARRIED CONTAINER
100345	1	4	9	3.773	33	2	2	CARRIED CONTAINER
100174	1	4	9	3.745	33	2	3	CARRIED CONTAINER
100721	1	4	9	3.709	33	2	4	CARRIED CONTAINER
100828	1	4	9	3.705	33	2	5	CARRIED CONTAINER
100642	1	4	9	3.662	33	2	6	CARRIED CONTAINER
100101	1	4	9	3.659	38	2	1	CARRIED CONTAINER
100921	1	4	9	3.648	38	2	2	CARRIED CONTAINER
100290	1	4	9	3.637	38	2	3	CARRIED CONTAINER
100783	1	4	9	3.623	38	2	4	CARRIED CONTAINER
100199	1	4	9	3.617	38	2	5	CARRIED CONTAINER
100236	1	4	9	3.485	38	2	6	CARRIED CONTAINER
100374	1	4	9	3.478	39	2	1	CARRIED CONTAINER
100904	1	4	9	3.467	39	2	2	CARRIED CONTAINER
100310	1	4	9	3.406	39	2	3	CARRIED CONTAINER
100851	1	4	9	3.401	39	2	4	CARRIED CONTAINER
100262	1	4	9	3.302	39	2	5	CARRIED CONTAINER
100289	1	4	9	3.298	39	2	6	CARRIED CONTAINER
100742	1	4	9	3.258	40	2	1	CARRIED CONTAINER
100910	1	4	9	3.254	40	2	2	CARRIED CONTAINER
100538	1	4	9	3.235	40	2	3	CARRIED CONTAINER
100933	1	4	9	3.232	40	2	4	CARRIED CONTAINER
100181	1	4	9	3.214	40	2	5	CARRIED CONTAINER

100747	1	4	9	3.200	40	2	6	CARRIED CONTAINER
100548	1	4	9	3.189	41	2	1	CARRIED CONTAINER
100714	1	4	9	3.147	41	2	2	CARRIED CONTAINER
100885	1	4	9	3.092	41	2	3	CARRIED CONTAINER
100932	1	4	9	3.022	41	2	4	CARRIED CONTAINER
100255	1	4	9	2.990	41	2	5	CARRIED CONTAINER
100339	1	4	9	2.950	41	2	6	CARRIED CONTAINER
100456	1	4	9	2.930	46	2	1	CARRIED CONTAINER
100644	1	4	9	2.876	46	2	2	CARRIED CONTAINER
100245	1	4	9	2.816	46	2	3	CARRIED CONTAINER
100206	1	4	9	2.785	46	2	4	CARRIED CONTAINER
100032	1	4	9	2.742	46	2	5	CARRIED CONTAINER
100371	1	4	9	2.628	46	2	6	CARRIED CONTAINER
100188	1	4	9	2.521	47	2	1	CARRIED CONTAINER
100661	1	4	9	2.475	47	2	2	CARRIED CONTAINER
100909	1	4	9	2.335	47	2	3	CARRIED CONTAINER
100541	1	4	9	2.334	47	2	4	CARRIED CONTAINER
100446	1	4	9	2.298	47	2	5	CARRIED CONTAINER
100161	1	4	9	2.233	47	2	6	CARRIED CONTAINER
100338	1	4	9	2.170	48	2	1	CARRIED CONTAINER
100287	1	4	9	2.122	48	2	2	CARRIED CONTAINER
100410	1	4	9	2.097	48	2	3	CARRIED CONTAINER
100281	1	4	9	2.067	48	2	4	CARRIED CONTAINER
100365	1	4	9	2.035	48	2	5	CARRIED CONTAINER
100225	1	4	9	1.992	48	2	6	CARRIED CONTAINER
100760	1	4	9	1.969	49	2	1	CARRIED CONTAINER
100348	1	4	9	1.866	49	2	2	CARRIED CONTAINER
100323	1	4	9	1.844	49	2	3	CARRIED CONTAINER
100030	1	4	9	1.829	49	2	4	CARRIED CONTAINER
100680	1	4	9	1.825	49	2	5	CARRIED CONTAINER
100334	1	4	9	1.766	49	2	6	CARRIED CONTAINER
100089	1	4	9	1.753	7	6	2	CARRIED CONTAINER
100252	1	4	9	1.743	7	6	3	CARRIED CONTAINER
100527	1	4	9	1.588	7	6	4	CARRIED CONTAINER
100409	1	4	9	1.565	7	6	5	CARRIED CONTAINER
100164	1	4	9	1.504	7	6	6	CARRIED CONTAINER
100301	1	4	9	1.495	8	6	2	CARRIED CONTAINER
100726	1	4	9	1.411	8	6	3	CARRIED CONTAINER
100104	1	4	9	1.342	8	6	4	CARRIED CONTAINER
100346	1	4	9	1.322	8	6	5	CARRIED CONTAINER

100560	1	4	9	1.312	8	6	6	CARRIED CONTAINER
100543	1	4	9	1.305	9	6	2	CARRIED CONTAINER
100931	1	4	9	1.248	9	6	3	CARRIED CONTAINER
100750	1	4	9	1.233	9	6	4	CARRIED CONTAINER
100775	1	4	9	1.161	9	6	5	CARRIED CONTAINER
100523	1	4	9	1.151	9	6	6	CARRIED CONTAINER
100321	1	4	9	1.147	10	6	2	CARRIED CONTAINER
100095	1	4	9	1.143	10	6	3	CARRIED CONTAINER
100063	1	4	9	1.057	10	6	4	CARRIED CONTAINER
100901	1	4	9	1.019	10	6	5	CARRIED CONTAINER
100736	1	4	9	0.977	10	6	6	CARRIED CONTAINER
100604	1	4	9	0.799	11	6	2	CARRIED CONTAINER
100269	1	4	9	0.794	11	6	3	CARRIED CONTAINER
100237	1	4	9	0.651	11	6	4	CARRIED CONTAINER
100535	1	4	9	0.650	11	6	5	CARRIED CONTAINER
100259	1	4	9	0.549	11	6	6	CARRIED CONTAINER
100850	1	4	9	0.543	16	6	2	CARRIED CONTAINER
100791	1	4	9	0.502	16	6	3	CARRIED CONTAINER
100062	1	4	9	0.455	16	6	4	CARRIED CONTAINER
100887	1	4	9	0.410	16	6	5	CARRIED CONTAINER
100098	1	4	9	0.300	16	6	6	CARRIED CONTAINER
100529	1	4	9	0.300	17	6	2	CARRIED CONTAINER
100801	1	4	9	0.300	17	6	3	CARRIED CONTAINER
100324	1	4	9	0.300	17	6	4	CARRIED CONTAINER
100270	1	4	9	0.300	17	6	5	CARRIED CONTAINER
100042	1	4	9	0.300	17	6	6	CARRIED CONTAINER
100307	1	4	9	0.300	18	6	2	CARRIED CONTAINER
100280	1	4	9	0.300	18	6	3	CARRIED CONTAINER
100622	1	4	9	0.300	18	6	4	CARRIED CONTAINER
100542	1	4	9	0.300	18	6	5	CARRIED CONTAINER
200055	2	4	9	9.665	19	4	6	
200063	2	4	9	9.283	32	4	3	
200095	2	4	9	9.036	32	4	4	
200138	2	4	9	9.015	32	4	5	
200082	2	4	9	8.909	32	4	6	
200096	2	4	9	8.426	33	4	1	
200118	2	4	9	8.186	33	4	2	
200073	2	4	9	7.202	33	4	3	
200133	2	4	9	6.849	33	4	4	
200004	2	4	9	6.709	33	4	5	

200023	2	4	9	6.443	33	4	6
200008	2	4	9	5.666	38	4	1
200087	2	4	9	5.526	38	4	2
200054	2	4	9	5.461	38	4	3
200027	2	4	9	4.825	38	4	4
200115	2	4	9	4.254	38	4	5
200017	2	4	9	4.112	38	4	6
200123	2	4	9	3.847	39	4	1
200037	2	4	9	2.749	39	4	2
200085	2	4	9	2.684	39	4	3
200010	2	4	9	2.642	39	4	4
200043	2	4	9	2.085	39	4	5
200088	2	4	9	1.794	39	4	6
200103	2	4	9	1.742	40	4	5
200076	2	4	9	1.599	40	4	6
200126	2	4	9	1.275	41	4	1
200077	2	4	9	0.929	41	4	2

MANIFEST OF CARGO CONTAINERS TO PORT NO.3

ORDER OF LOADING PORT ON THE ROUTE: 2

CARGO TYPE 1

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100433	1	3	1	9.451	7	3	2	CARRIED CONTAINER
100782	1	3	1	9.316	7	3	3	CARRIED CONTAINER
100162	1	3	1	9.091	7	3	4	CARRIED CONTAINER
100789	1	3	1	8.500	7	3	5	CARRIED CONTAINER
100205	1	3	1	8.264	7	3	6	CARRIED CONTAINER
100477	1	3	1	7.958	8	3	2	CARRIED CONTAINER
100820	1	3	1	7.805	8	3	3	CARRIED CONTAINER
100249	1	3	1	7.350	8	3	4	CARRIED CONTAINER
100311	1	3	1	6.599	8	3	5	CARRIED CONTAINER
100823	1	3	1	5.695	8	3	6	CARRIED CONTAINER
100274	1	3	1	5.324	9	3	2	CARRIED CONTAINER
100454	1	3	1	5.102	9	3	3	CARRIED CONTAINER
100854	1	3	1	4.908	9	3	4	CARRIED CONTAINER
100022	1	3	1	4.640	9	3	5	CARRIED CONTAINER
100117	1	3	1	4.547	9	3	6	CARRIED CONTAINER
100734	1	3	1	4.189	7	5	2	CARRIED CONTAINER
100077	1	3	1	3.969	7	5	3	CARRIED CONTAINER
100472	1	3	1	3.551	7	5	4	CARRIED CONTAINER
100659	1	3	1	3.488	7	5	5	CARRIED CONTAINER
100840	1	3	1	2.844	7	5	6	CARRIED CONTAINER
100868	1	3	1	2.758	8	5	2	CARRIED CONTAINER
100180	1	3	1	2.490	8	5	3	CARRIED CONTAINER
100291	1	3	1	2.150	8	5	4	CARRIED CONTAINER
100141	1	3	1	1.796	8	5	5	CARRIED CONTAINER
100296	1	3	1	1.668	8	5	6	CARRIED CONTAINER
100697	1	3	1	1.342	9	5	2	CARRIED CONTAINER
100674	1	3	1	0.774	9	5	3	CARRIED CONTAINER
200098	2	3	1	3.076	48	4	1	
200156	2	3	1	2.474	48	4	2	
200003	2	3	1	0.567	48	4	3	

CARGO TYPE 2

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER

100929	1	3	2	9.180	10	3	5	CARRIED CONTAINER
100710	1	3	2	8.636	10	3	6	CARRIED CONTAINER
100475	1	3	2	5.680	11	3	5	CARRIED CONTAINER
100385	1	3	2	5.406	11	3	6	CARRIED CONTAINER
100234	1	3	2	0.300	10	5	5	CARRIED CONTAINER
200081	2	3	2	1.066	48	4	5	

CARGO TYPE 3

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100624	1	3	3	7.524	16	3	2	CARRIED CONTAINER
100583	1	3	3	7.135	16	3	3	CARRIED CONTAINER
100094	1	3	3	6.814	16	3	4	CARRIED CONTAINER
100667	1	3	3	6.779	16	3	5	CARRIED CONTAINER
100614	1	3	3	6.040	16	3	6	CARRIED CONTAINER
100342	1	3	3	4.226	17	3	2	CARRIED CONTAINER
100040	1	3	3	0.537	17	3	3	CARRIED CONTAINER
200065	2	3	3	2.886	48	4	4	

CARGO TYPE 4

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100303	1	3	4	7.368	18	6	6	CARRIED CONTAINER
100349	1	3	4	6.474	19	6	2	CARRIED CONTAINER
100920	1	3	4	3.368	19	6	3	CARRIED CONTAINER
100601	1	3	4	3.180	19	6	4	CARRIED CONTAINER
100691	1	3	4	1.384	19	6	5	CARRIED CONTAINER
200136	2	3	4	9.733	48	4	6	
200132	2	3	4	3.221	49	4	1	

CARGO TYPE 5

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100455	1	3	5	8.936	30	6	5	CARRIED CONTAINER

100607	1	3	5	5.797	30	6	6	CARRIED CONTAINER
100508	1	3	5	4.807	31	6	5	CARRIED CONTAINER
100018	1	3	5	1.183	31	6	6	CARRIED CONTAINER
100663	1	3	5	1.112	30	3	5	CARRIED CONTAINER

CARGO TYPE 6

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100744	1	3	6	7.664	32	6	1	CARRIED CONTAINER
100124	1	3	6	5.886	32	6	2	CARRIED CONTAINER
100767	1	3	6	2.005	32	6	3	CARRIED CONTAINER
100036	1	3	6	1.503	32	6	4	CARRIED CONTAINER
100883	1	3	6	1.009	32	6	5	CARRIED CONTAINER
100439	1	3	6	0.300	32	6	6	CARRIED CONTAINER
200086	2	3	6	7.266	49	4	2	

CARGO TYPE 7

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100381	1	3	7	7.162	38	6	1	CARRIED CONTAINER
100602	1	3	7	6.879	38	6	2	CARRIED CONTAINER
100015	1	3	7	6.362	38	6	3	CARRIED CONTAINER
100841	1	3	7	5.844	38	6	4	CARRIED CONTAINER
100428	1	3	7	5.264	38	6	5	CARRIED CONTAINER
100620	1	3	7	5.222	38	6	6	CARRIED CONTAINER
100556	1	3	7	4.857	39	6	1	CARRIED CONTAINER
100248	1	3	7	4.077	39	6	2	CARRIED CONTAINER
100928	1	3	7	0.802	39	6	3	CARRIED CONTAINER
200107	2	3	7	6.261	49	4	3	

CARGO TYPE 8

	PORT				ADDRESS			
SER-NO.	DEP	ARR	TYPE	WEIGHT	ROW	COL	TIER	
100048	1	3	8	9.906	40	6	1	CARRIED CONTAINER

100732	1	3	8	6.331	40	6	2	CARRIED CONTAINER
100144	1	3	8	4.056	40	6	3	CARRIED CONTAINER
100914	1	3	8	2.900	40	6	4	CARRIED CONTAINER
100045	1	3	8	2.069	40	6	5	CARRIED CONTAINER
100114	1	3	8	1.967	40	6	6	CARRIED CONTAINER

CARGO TYPE 9

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER	
100555	1	3	9	9.940	19	6	6	CARRIED CONTAINER
100458	1	3	9	9.805	30	6	1	CARRIED CONTAINER
100912	1	3	9	9.803	30	6	2	CARRIED CONTAINER
100451	1	3	9	9.796	30	6	3	CARRIED CONTAINER
100026	1	3	9	9.760	30	6	4	CARRIED CONTAINER
100892	1	3	9	9.649	31	6	1	CARRIED CONTAINER
100780	1	3	9	9.431	31	6	2	CARRIED CONTAINER
100350	1	3	9	9.402	31	6	3	CARRIED CONTAINER
100240	1	3	9	9.358	31	6	4	CARRIED CONTAINER
100330	1	3	9	9.224	33	6	1	CARRIED CONTAINER
100420	1	3	9	9.222	33	6	2	CARRIED CONTAINER
100673	1	3	9	9.216	33	6	3	CARRIED CONTAINER
100470	1	3	9	9.195	33	6	4	CARRIED CONTAINER
100295	1	3	9	9.169	33	6	5	CARRIED CONTAINER
100733	1	3	9	9.064	33	6	6	CARRIED CONTAINER
100739	1	3	9	9.059	39	6	4	CARRIED CONTAINER
100009	1	3	9	9.033	39	6	5	CARRIED CONTAINER
100501	1	3	9	9.014	39	6	6	CARRIED CONTAINER
100279	1	3	9	9.006	41	6	1	CARRIED CONTAINER
100461	1	3	9	8.977	41	6	2	CARRIED CONTAINER
100160	1	3	9	8.658	41	6	3	CARRIED CONTAINER
100402	1	3	9	8.621	41	6	4	CARRIED CONTAINER
100467	1	3	9	8.549	41	6	5	CARRIED CONTAINER
100492	1	3	9	8.543	41	6	6	CARRIED CONTAINER
100221	1	3	9	8.536	46	6	1	CARRIED CONTAINER
100078	1	3	9	8.534	46	6	2	CARRIED CONTAINER
100182	1	3	9	8.480	46	6	3	CARRIED CONTAINER
100836	1	3	9	8.428	46	6	4	CARRIED CONTAINER
100706	1	3	9	8.378	46	6	5	CARRIED CONTAINER

100123	1	3	9	8.369	46	6	6	CARRIED CONTAINER
100109	1	3	9	8.360	47	6	1	CARRIED CONTAINER
100718	1	3	9	8.339	47	6	2	CARRIED CONTAINER
100394	1	3	9	8.291	47	6	3	CARRIED CONTAINER
100636	1	3	9	8.263	47	6	4	CARRIED CONTAINER
100660	1	3	9	8.248	47	6	5	CARRIED CONTAINER
100844	1	3	9	8.224	47	6	6	CARRIED CONTAINER
100491	1	3	9	8.216	48	6	1	CARRIED CONTAINER
100010	1	3	9	8.175	48	6	2	CARRIED CONTAINER
100165	1	3	9	8.173	48	6	3	CARRIED CONTAINER
100810	1	3	9	8.161	48	6	4	CARRIED CONTAINER
100651	1	3	9	8.056	48	6	5	CARRIED CONTAINER
100415	1	3	9	8.051	48	6	6	CARRIED CONTAINER
100389	1	3	9	7.933	49	6	1	CARRIED CONTAINER
100079	1	3	9	7.763	49	6	2	CARRIED CONTAINER
100071	1	3	9	7.746	49	6	3	CARRIED CONTAINER
100547	1	3	9	7.684	49	6	4	CARRIED CONTAINER
100881	1	3	9	7.614	49	6	5	CARRIED CONTAINER
100899	1	3	9	7.605	49	6	6	CARRIED CONTAINER
100268	1	3	9	7.589	10	3	2	CARRIED CONTAINER
100692	1	3	9	7.566	10	3	3	CARRIED CONTAINER
100479	1	3	9	7.239	10	3	4	CARRIED CONTAINER
100598	1	3	9	7.216	11	3	2	CARRIED CONTAINER
100864	1	3	9	7.143	11	3	3	CARRIED CONTAINER
100728	1	3	9	7.126	11	3	4	CARRIED CONTAINER
100643	1	3	9	7.083	17	3	4	CARRIED CONTAINER
100484	1	3	9	7.017	17	3	5	CARRIED CONTAINER
100408	1	3	9	6.972	17	3	6	CARRIED CONTAINER
100830	1	3	9	6.948	18	3	2	CARRIED CONTAINER
100824	1	3	9	6.867	18	3	3	CARRIED CONTAINER
100333	1	3	9	6.808	18	3	4	CARRIED CONTAINER
100906	1	3	9	6.739	18	3	5	CARRIED CONTAINER
100774	1	3	9	6.611	18	3	6	CARRIED CONTAINER
100383	1	3	9	6.521	19	3	2	CARRIED CONTAINER
100778	1	3	9	6.506	19	3	3	CARRIED CONTAINER
100839	1	3	9	6.485	19	3	4	CARRIED CONTAINER
100361	1	3	9	6.462	19	3	5	CARRIED CONTAINER
100488	1	3	9	6.438	19	3	6	CARRIED CONTAINER
100590	1	3	9	6.418	30	3	1	CARRIED CONTAINER
100819	1	3	9	6.410	30	3	2	CARRIED CONTAINER

100891	1	3	9	6.390	30	3	3	CARRIED CONTAINER
100027	1	3	9	6.319	30	3	4	CARRIED CONTAINER
100519	1	3	9	6.285	30	3	6	CARRIED CONTAINER
100511	1	3	9	6.284	31	3	1	CARRIED CONTAINER
100302	1	3	9	6.250	31	3	2	CARRIED CONTAINER
100575	1	3	9	6.120	31	3	3	CARRIED CONTAINER
100441	1	3	9	6.078	31	3	4	CARRIED CONTAINER
100043	1	3	9	6.078	31	3	5	CARRIED CONTAINER
100595	1	3	9	5.907	31	3	6	CARRIED CONTAINER
100187	1	3	9	5.845	32	3	1	CARRIED CONTAINER
100430	1	3	9	5.829	32	3	2	CARRIED CONTAINER
100067	1	3	9	5.826	32	3	3	CARRIED CONTAINER
100021	1	3	9	5.816	32	3	4	CARRIED CONTAINER
100727	1	3	9	5.668	32	3	5	CARRIED CONTAINER
100903	1	3	9	5.545	32	3	6	CARRIED CONTAINER
100419	1	3	9	5.482	33	3	1	CARRIED CONTAINER
100720	1	3	9	5.474	33	3	2	CARRIED CONTAINER
100787	1	3	9	5.438	33	3	3	CARRIED CONTAINER
100085	1	3	9	5.433	33	3	4	CARRIED CONTAINER
100216	1	3	9	5.341	33	3	5	CARRIED CONTAINER
100360	1	3	9	5.299	33	3	6	CARRIED CONTAINER
100213	1	3	9	5.247	38	3	1	CARRIED CONTAINER
100200	1	3	9	5.241	38	3	2	CARRIED CONTAINER
100417	1	3	9	5.234	38	3	3	CARRIED CONTAINER
100870	1	3	9	5.168	38	3	4	CARRIED CONTAINER
100147	1	3	9	5.155	38	3	5	CARRIED CONTAINER
100148	1	3	9	5.118	38	3	6	CARRIED CONTAINER
100580	1	3	9	5.046	39	3	1	CARRIED CONTAINER
100701	1	3	9	5.021	39	3	2	CARRIED CONTAINER
100857	1	3	9	4.975	39	3	3	CARRIED CONTAINER
100139	1	3	9	4.972	39	3	4	CARRIED CONTAINER
100874	1	3	9	4.948	39	3	5	CARRIED CONTAINER
100034	1	3	9	4.919	39	3	6	CARRIED CONTAINER
100869	1	3	9	4.915	40	3	1	CARRIED CONTAINER
100282	1	3	9	4.889	40	3	2	CARRIED CONTAINER
100681	1	3	9	4.774	40	3	3	CARRIED CONTAINER
100093	1	3	9	4.769	40	3	4	CARRIED CONTAINER
100407	1	3	9	4.739	40	3	5	CARRIED CONTAINER
100422	1	3	9	4.671	40	3	6	CARRIED CONTAINER
100687	1	3	9	4.551	41	3	1	CARRIED CONTAINER

100434	1	3	9	4.399	41	3	2	CARRIED CONTAINER
100209	1	3	9	4.346	41	3	3	CARRIED CONTAINER
100367	1	3	9	4.335	41	3	4	CARRIED CONTAINER
100768	1	3	9	4.332	41	3	5	CARRIED CONTAINER
100762	1	3	9	4.315	41	3	6	CARRIED CONTAINER
100223	1	3	9	4.287	46	3	1	CARRIED CONTAINER
100494	1	3	9	4.248	46	3	2	CARRIED CONTAINER
100654	1	3	9	4.170	46	3	3	CARRIED CONTAINER
100725	1	3	9	4.102	46	3	4	CARRIED CONTAINER
100564	1	3	9	4.041	46	3	5	CARRIED CONTAINER
100700	1	3	9	4.027	46	3	6	CARRIED CONTAINER
100872	1	3	9	4.000	47	3	1	CARRIED CONTAINER
100137	1	3	9	3.897	47	3	2	CARRIED CONTAINER
100752	1	3	9	3.892	47	3	3	CARRIED CONTAINER
100146	1	3	9	3.886	47	3	4	CARRIED CONTAINER
100300	1	3	9	3.751	47	3	5	CARRIED CONTAINER
100397	1	3	9	3.729	47	3	6	CARRIED CONTAINER
100495	1	3	9	3.704	48	3	1	CARRIED CONTAINER
100597	1	3	9	3.698	48	3	2	CARRIED CONTAINER
100261	1	3	9	3.664	48	3	3	CARRIED CONTAINER
100355	1	3	9	3.606	48	3	4	CARRIED CONTAINER
100066	1	3	9	3.520	48	3	5	CARRIED CONTAINER
100705	1	3	9	3.518	48	3	6	CARRIED CONTAINER
100703	1	3	9	3.433	49	3	1	CARRIED CONTAINER
100806	1	3	9	3.431	49	3	2	CARRIED CONTAINER
100069	1	3	9	3.425	49	3	3	CARRIED CONTAINER
100163	1	3	9	3.310	49	3	4	CARRIED CONTAINER
100563	1	3	9	3.273	49	3	5	CARRIED CONTAINER
100550	1	3	9	3.213	49	3	6	CARRIED CONTAINER
100573	1	3	9	3.210	9	5	4	CARRIED CONTAINER
100150	1	3	9	3.155	9	5	5	CARRIED CONTAINER
100468	1	3	9	3.102	9	5	6	CARRIED CONTAINER
100776	1	3	9	3.084	10	5	2	CARRIED CONTAINER
100203	1	3	9	2.886	10	5	3	CARRIED CONTAINER
100485	1	3	9	2.880	10	5	4	CARRIED CONTAINER
100893	1	3	9	2.843	10	5	6	CARRIED CONTAINER
100729	1	3	9	2.841	11	5	2	CARRIED CONTAINER
100640	1	3	9	2.816	11	5	3	CARRIED CONTAINER
100411	1	3	9	2.685	11	5	4	CARRIED CONTAINER
100414	1	3	9	2.663	11	5	5	CARRIED CONTAINER

100253	1	3	9	2.654	11	5	6	CARRIED CONTAINER
100423	1	3	9	2.654	16	5	2	CARRIED CONTAINER
100369	1	3	9	2.649	16	5	3	CARRIED CONTAINER
100284	1	3	9	2.485	16	5	4	CARRIED CONTAINER
100051	1	3	9	2.482	16	5	5	CARRIED CONTAINER
100276	1	3	9	2.316	16	5	6	CARRIED CONTAINER
100153	1	3	9	2.229	17	5	2	CARRIED CONTAINER
100198	1	3	9	2.209	17	5	3	CARRIED CONTAINER
100314	1	3	9	2.196	17	5	4	CARRIED CONTAINER
100842	1	3	9	2.157	17	5	5	CARRIED CONTAINER
100329	1	3	9	2.148	17	5	6	CARRIED CONTAINER
100804	1	3	9	1.964	18	5	2	CARRIED CONTAINER
100630	1	3	9	1.939	18	5	3	CARRIED CONTAINER
100039	1	3	9	1.870	18	5	4	CARRIED CONTAINER
100628	1	3	9	1.722	18	5	5	CARRIED CONTAINER
100012	1	3	9	1.710	18	5	6	CARRIED CONTAINER
100717	1	3	9	1.687	19	5	2	CARRIED CONTAINER
100609	1	3	9	1.527	19	5	3	CARRIED CONTAINER
100047	1	3	9	1.524	19	5	4	CARRIED CONTAINER
100465	1	3	9	1.506	19	5	5	CARRIED CONTAINER
100890	1	3	9	1.434	19	5	6	CARRIED CONTAINER
100930	1	3	9	1.364	30	5	1	CARRIED CONTAINER
100616	1	3	9	1.185	30	5	2	CARRIED CONTAINER
100218	1	3	9	1.156	30	5	3	CARRIED CONTAINER
100833	1	3	9	1.154	30	5	4	CARRIED CONTAINER
100652	1	3	9	1.148	30	5	5	CARRIED CONTAINER
100713	1	3	9	1.095	30	5	6	CARRIED CONTAINER
100655	1	3	9	1.091	31	5	1	CARRIED CONTAINER
100215	1	3	9	1.088	31	5	2	CARRIED CONTAINER
100082	1	3	9	1.013	31	5	3	CARRIED CONTAINER
100129	1	3	9	1.004	31	5	4	CARRIED CONTAINER
100592	1	3	9	0.740	31	5	5	CARRIED CONTAINER
100337	1	3	9	0.733	31	5	6	CARRIED CONTAINER
100549	1	3	9	0.702	32	5	1	CARRIED CONTAINER
100684	1	3	9	0.655	32	5	2	CARRIED CONTAINER
100797	1	3	9	0.581	32	5	3	CARRIED CONTAINER
100128	1	3	9	0.555	32	5	4	CARRIED CONTAINER
100764	1	3	9	0.502	32	5	5	CARRIED CONTAINER
100865	1	3	9	0.464	32	5	6	CARRIED CONTAINER
100265	1	3	9	0.375	33	5	1	CARRIED CONTAINER

100426	1	3	9	0.359	33	5	2	CARRIED CONTAINER
100097	1	3	9	0.347	33	5	3	CARRIED CONTAINER
100275	1	3	9	0.300	33	5	4	CARRIED CONTAINER
100699	1	3	9	0.300	33	5	5	CARRIED CONTAINER
100537	1	3	9	0.300	33	5	6	CARRIED CONTAINER
200080	2	3	9	9.546	41	4	3	
200148	2	3	9	9.075	41	4	4	
200006	2	3	9	7.818	41	4	5	
200014	2	3	9	7.513	41	4	6	
200084	2	3	9	6.965	49	4	4	
200079	2	3	9	6.494	49	4	5	
200101	2	3	9	6.217	49	4	6	

SUMMARY MANIFEST

LIST OF LABELED CONTAINERS NOT IN SEPARATE HOLD.

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER
200146	2	4	1	5.655	46	4	6
200083	2	4	1	3.736	47	4	1
200050	2	4	1	3.235	47	4	2
200098	2	3	1	3.076	48	4	1
200156	2	3	1	2.474	48	4	2
200145	2	4	1	2.320	47	4	3
200007	2	4	1	1.943	47	4	4
200003	2	3	1	0.567	48	4	3
200081	2	3	2	1.066	48	4	5
200028	2	4	3	5.483	47	4	5
200065	2	3	3	2.886	48	4	4
200136	2	3	4	9.733	48	4	6
200132	2	3	4	3.221	49	4	1
200040	2	4	5	9.382	47	4	6
200130	2	5	5	3.884	46	4	5
200086	2	3	6	7.266	49	4	2
200107	2	3	7	6.261	49	4	3

NOTE: IT MIGHT NOT BE APPROPRIATE TO STOW THESE CONTAINERS AT THOSE LOCATIONS. RULES ON LABELED CARGO SHOULD BE CHECKED FOR EACH CONTAINER.

LIST OF CONTAINERS THAT HAVE NOT BEEN LOADED

SER-NO.	PORT DEP	PORT ARR	TYPE	WEIGHT	ADDRESS ROW	ADDRESS COL	ADDRESS TIER
200142	2	3	9	6.215			
200022	2	3	9	6.162			
200047	2	3	9	4.464			
200137	2	3	9	4.339			
200099	2	3	9	3.872			
200013	2	3	9	3.231			
200072	2	3	9	2.151			
200094	2	3	9	1.837			
200117	2	3	9	1.577			
200015	2	3	9	0.641			
200059	2	3	9	0.635			
200114	2	3	9	0.300			

UNOCCUPIED ADDRESSES AND ORDER OF CALL PORT OF CARGO
OF CARGO PARTIALLY OCCUPYING THE STACK

30	4	1	4
30	4	2	4
30	4	3	4
30	4	4	4
31	4	1	4
31	4	2	4
31	4	3	4
31	4	4	4
46	4	1	4
46	4	2	4
46	4	3	4
46	4	4	4

TRIM CALCULATION.

FORWARD DRAFT	AFT-DRAFT	MEAN	TOTAL WEIGHT
28.427	9.893	19.165	8532.582

WATER ADDED TO AFT-BALLAST TO KEEP SHIP TRIM EQUAL ZERO 107.377TONS

COMPUTER PROGRAM

MAIN

```
      COMMON/C1/K,L,JC,JR,JT,KRORIG,MTIER,MAXCOL,MLOWER,MAC,MAXROW(10),
     1 LOG(10,60,10)
      COMMON/C2/NCONT,ISER(3000),IPDEP(3000),IPARR(3000),ITYPE(3000),
     1 WEIGHT(3000),ICOL(3000),IROW(3000),ITIER(3000)
      COMMON /C3/ DISP,DRAAFT,DRAFWD,SHMEAN,SHLGTH,W,CL,SHMTI,A,T,DIFF,
     1 Y,AA,AB,AC,AD,AE,AF,AG,AH,AI,AJ,BA,BB,BC,BD,BE,BF,BG,BH,BI,BJ,
     1   CA,CB,CC,CD,CE,CF,CG,CH,CI,CJ,D,BAL1,BAL2, MOMT,WATER
      READ(8,100)MAXCOL,MTIER,NCONT,NP,NLOADP ,MLOWER
      READ(8,100)(MAXROW(I),I=1,9)
100   FORMAT(10I5)
      READ(8,105)(ISER(I),IPDEP(I),IPARR(I),ITYPE(I),WEIGHT(I),
     1 IROW(I),ICOL(I),ITIER(I),I=1,NCONT)
105   FORMAT(1I10,3I5,F10.3,I10,2I5)
110   FORMAT(1I10,3I5,F10.3,I10,2I5)
115   FORMAT(10F8.2)
      READ(5,115)DISP,DRAAFT,DRAFWD,SHMEAN,SHLGTH,CL,D,BAL1,BAL2
      READ(5,115)AA,AB,AC,AD,AE,AF,AG,AH,AI,AJ
      READ(5,115)BA,BB,BC,BD,BE,BF,BG,BH,BI,BJ
      READ(5,115)CA,CB,CC,CD,CE,CF,CG,CH,CI,CJ
C
C*****SORT CONTAINERS INTO DECREASING WEIGHT ORDER.
C
      CALL SORT
C
C*****INITIALIZATON.
C
      DO 1 I=1,10
      DO 1 J=1,60
      DO 1 K=1,10
      LOG(I,J,K) =0
    1 CONTINUE
C
C*****REGISTER THE ADDRESSES OF OCCUPIED LOCATIONS.
C
      DO 2 I=1,NCONT
      IF(IROW(I).EQ.0)GO TO 2
      JC=ICOL(I)
      JR=IROW(I)
      JT=ITIER(I)
      LOG(JC,JR,JT)=IPARR(I)-(NLOADP-1)
      IF(LOG(JC,JR,JT).LE.0)LOG(JC,JR,JT)=NP+LOG(JC,JR,JT)
      IF(IPARR(I).EQ.0) LOG(JC,JR,JT)=NP
    2 CONTINUE
C
C*****DETERMINE THE  MIDDLE COLUMN NUMBER.
C
      MAC=MAXCOL/2
      IF(MAC.NE.FLOAT(MAXCOL)/2.)MAC=(MAXCOL+1)/2
```

```
C
C*****GROUP CONTAINERS INTO PORT OF DESTINATION.
C
      N1=NP-1
      DO 6 J=1,N1
      K=NP-J+1
      NARRP=K+NLOADP-1
      IF(NARRP.GT.NP)NARRP=NARRP-NP
      WRITE(6,120)NARRP
120   FORMAT('1              MANIFEST OF CARGO CONTAINERS TO PORT NO.',1I1)
      WRITE(6,125)NLOADP
125   FORMAT('0',12X,'ORDER OF LOADING PORT ON THE ROUTE: ',I1)
C
C*****GROUP OF CONTAINERS INTO SPECIAL TYPES.
C
      DO 6 L=1,9
      KRORIG=0
      DO 4 N=1,L
    4 KRORIG=KRORIG+MAXROW(N)
      JR=KRORIG-MAXROW(L)
      IF(L.EQ.9)JR=0
      JC=MAXCOL
      JT=MTIER
      WRITE(6,130) L
130   FORMAT('0                                CARGO TYPE ',1I1)
      WRITE(6,135)
135   FORMAT('0                    PORT                              ADDRESS')
      WRITE(6,140)
140   FORMAT('     SER-NO.  DEP  ARR  TYPE  WEIGHT          ROW  COL TIER')
      WRITE(6,110)
C
C*****PRINT OUT THE ADDRESSES OF CARRIED CONTAINERS.
C
      DO 5 M=1,NP
      DO 5 I=1,NCONT
      IF(IPDEP(I).NE.M) GO TO 5
      IF(ITYPE(I).NE.L) GO TO 5
      IF(IPARR(I).NE.NARRP)GO TO 5
      IF(IROW(I).EQ.0) GO TO 5
      WRITE(6,110)ISER(I),IPDEP(I),IPARR(I),ITYPE(I),WEIGHT(I),
     1 IROW(I),ICOL(I),ITIER(I)
      WRITE(6,150)
150   FORMAT('+',60X,'CARRIED CONTAINER')
      W=WEIGHT(I)
      A=FLOAT(IROW(I))
      CALL TRIM
    5 CONTINUE
C
```

```
C*****ASSIGN ADDRESSES FOR NEW CONTAINERS.
C
      DO 6 I=1,NCONT
      IF(ITYPE(I).NE.L) GO TO 6
      IF(IPARR(I).NE.NARRP)GO TO 6
      IF(IROW(I).NE.0) GO TO 6
      CALL POST
      IF(JT.EQ.(MTIER+1)) GO TO 6
      ICOL(I)=JC
      IROW(I)=JR
      ITIER(I)=JT
      WRITE(6,110)ISER(I),IPDEP(I),IPARR(I),ITYPE(I),WEIGHT(I),
     1 IROW(I),ICOL(I),ITIER(I)
      W=WEIGHT(I)
      A=FLOAT(IROW(I))
      CALL TRIM
    6 CONTINUE
C
C*****LIST OF LABELED CONTAINERS WHICH ARE NOT STOWED IN RESERVED HOLDS.
C
      WRITE(6,500)
500   FORMAT('1',35X,'SUMMARY MANIFEST')
185   FORMAT('0',20X,'LIST OF LABELED CONTAINERS NOT IN SEPARATE HOLD.')
      WRITE(6,185)
      WRITE(6,135)
      WRITE(6,140)
      WRITE(6,110)
      KRORIG=0
      DO 7 L=1,9
      KRORIG=KRORIG+MAXROW(L)
      DO 7 I=1,NCONT
      IF(ITYPE(I).NE.L) GO TO 7
      IF(IROW(I).LE.KRORIG) GO TO 7
      WRITE(6,110)ISER(I),IPDEP(I),IPARR(I),ITYPE(I),WEIGHT(I),
     1 IROW(I),ICOL(I),ITIER(I)
    7 CONTINUE
      WRITE(6,195)
195   FORMAT('0',5X,'NOTE:    IT MIGHT NOT BE APPROPRIATE TO STOW THESE
     1 CONTAINERS AT THOSE LOCATIONS.')
      WRITE(6,200)
200   FORMAT(15X,'RULES ON LABELED CARGO SHOULD BE CHECKED FOR EACH CONT
     1AINER.')
      WRITE(6,110)
C
C*****LIST OF CONTAINERS THAT HAVE NOT BEEN LOADED WITHOUT OVERSTOW.
C
      WRITE(6,170)
170   FORMAT('0',20X,   'LIST OF CONTAINERS THAT HAVE NOT BEEN LOADED')
```

```
      WRITE(6,135)
      WRITE(6,140)
      WRITE(6,110)
      DO 9 J=1,NCONT
    9 IF(IROW(J).EQ.0)WRITE(6,110)ISER(J),IPDEP(J),IPARR(J),ITYPE(J)
     1,WEIGHT(J)
      WRITE(6,110)
C
C*****LIST OF UNOCCUPIED ADDRESSES.
C
      WRITE(6,110)
      WRITE(6,175)
      WRITE(6,176)
175   FORMAT(20X,'UNOCCUPIED ADDRESSES AND ORDER OF CALL PORT OF CARGO')
176   FORMAT(27X,'OF CARGO PARTIALLY OCCUPYING THE STACK')
      WRITE(6,110)
      DO 11 I=1,MAXCOL
      DO 11 J=1,KRORIG
      DO 11 K=1,MTIER
      JL=MLOWER+1
   11 IF(LOG(I,J,K).EQ.0)WRITE(6,180)J,I,K,LOG(I,J,JL)
180   FORMAT(40X,4I5)
      WRITE(6,110)
      WRITE(6,110)
      WRITE(6,205)
205   FORMAT('0',30X,'TRIM CALCULATION.')
      WRITE(6,210)
210   FORMAT('0',10X,'FORWARD DRAFT     AFT-DRAFT          MEAN        TOTAL
     1L WEIGHT')
      WRITE(6,220)DRAFWD,DRAAFT,SHMEAN,DISP
220   FORMAT('0',10X,5(F10.3,5X))
      IF(MOMT.GT.0)WRITE(6,510) WATER
      IF(MOMT.LE.0)WRITE(6,520) WATER
510   FORMAT('0','WATER ADDED TO FWD-BALLAST TO KEEP SHIP TRIM EQUAL ZERO
     10',F10.3,' TONS')
520   FORMAT('0','WATER ADDED TO AFT-BALLAST TO KEEP SHIP TRIM EQUAL ZERO
     10',F10.3,' TONS')
      END
```

```
      SUBROUTINE SORT
      COMMON/C2/NCONT,ISER(3000),IPDEP(3000),IPARR(3000),ITYPE(3000),
     1 WEIGHT(3000),ICOL(3000),IROW(3000),ITIER(3000)
      NC=NCONT-1
      DO 1 I=1,NC
      I1=I+1
      DO 1 J=I1,NCONT
      IF(WEIGHT(J).LE.WEIGHT(I)) GO TO 1
      WES=WEIGHT(I)
      WEIGHT(I)=WEIGHT(J)
      WEIGHT(J)=WES
      ISERS=ISER(I)
      ISER(I)=ISER(J)
      ISER(J)=ISERS
      IPDEPS=IPDEP(I)
      IPDEP(I)=IPDEP(J)
      IPDEP(J)=IPDEPS
      IPARRS=IPARR(I)
      IPARK(I)=IPARR(J)
      IPARR(J)=IPARRS
      ITYPES=ITYPE(I)
      ITYPE(I)=ITYPE(J)
      ITYPE(J)=ITYPES
      ICOLS=ICOL(I)
      ICOL(I)=ICOL(J)
      ICOL(J)=ICOLS
      IROWS=IROW(I)
      IROW(I)=IROW(J)
      IROW(J)=IROWS
      ITIERS=ITIER(I)
      ITIER(I)=ITIER(J)
      ITIER(J)=ITIERS
    1 CONTINUE
      RETURN
      END
```

```
                   SUBROUTINE POST
      COMMON/C1/K,L,JC,JR,JT,KRORIG,MTIER,MAXCOL,MLOWER,MAC,MAXROW(10),
     1 LOG(10,60,10)
    1 IF(JT.NE.MTIER) GO TO 4
      IF(JC.NE.MAC) GO TO 4
      IF(JR.NE.KRORIG) GO TO 4
    2 JT=MTIER+1
      IF(L.EQ.9) RETURN
      KRORIG=0
      DO 3 N=1,9
    3 KRORIG=KRORIG+MAXROW(N)
      JR=KRORIG-MAXROW(9)
      GO TO 1
    4 JT=JT+1
      IF(JT.LE.MTIER) GO TO 5
      JT=1
      JR=JR+1
      IF(JR.LE.KRORIG) GO TO 5
      JR=KRORIG-MAXROW(L)
      IF(L.EQ.9) JR=0
      JT=MTIER
      INC=JC
      JC=MAXCOL-INC
      IF(INC.GE.MAXCOL/2)JC=MAXCOL-(INC-1)
      GO TO 1
    5 JL=MLOWER+1
      IF(LOG(JC,JR,JT).NE.0)GO TO 1
      IF(((JT.LE.MLOWER).AND.((L.EQ.2).OR.(L.EQ.5))))GO TO 1
      IF((LOG(JC,JR,JL).NE.0).AND.(K.LT.LOG(JC,JR,JL)).AND.(JT.LE.MLOWER
     1)) GO TO 1
      IF(LOG(JC,JR,1).EQ.0) GO TO 6
      IF(LOG(JC,JR,1).LT.K)GO TO 1
    6 LOG(JC,JR,JT)=K
      RETURN
      END
```

```
      SUBROUTINE TRIM
      COMMON /C3/ DISP,DRAAFT,DRAFWD,SHMEAN,SHLGTH,W,CL,SHMTI,A,T,DIFF,
     1 Y,AA,AB,AC,AD,AE,AF,AG,AH,AI,AJ,BA,BB,BC,BD,BE,BF,BG,BH,BI,BJ,
     1   CA,CB,CC,CD,CE,CF,CG,CH,CI,CJ,D,BAL1,BAL2, MOMT,WATER
      DISP=DISP+W
      CALL CURVE(Y,DISP,AA,AB,AC,AD,AE,AF,AG,AH,AI,AJ,BA,BB,BC,BD,BE,BF,
     1 BG,BH,BI,BJ)
      DIFF=Y-SHMEAN
      CALL CURVE(SHMTI,DISP,AA,AB,AC,AD,AE,AF,AG,AH,AI,AJ,CA,CB,CC,CD,CE
     1,CF,CG,CH,CI,CJ)
      T=((A-SHLGTH/2.)*CL-D)*W/SHMTI
      DRAAFT=DRAAFT+DIFF-T/2.
      DRAFWD=DRAFWD+DIFF+T/2.
      SHMEAN=SHMEAN+DIFF
      ADJ=DRAAFT-DRAFWD
      MCMT=ADJ*SHMTI
      IF(MOMT.GT.0)WATER=MOMT/(BAL2-SHLGTH*CL/2.-D)
      IF(MOMT.LE.0)WATER=MOMT/(BAL1-SHLGTH*CL/2.+D)
      RETURN
      END
```

```
      SUBROUTINE CURVE(Y,X,X0,X1,X2,X3,X4,X5,X6,X7,X8,X9,Y0,Y1,Y2,Y3,Y4,
     1 Y5,Y6,Y7,Y8,Y9)
      IF(X.LT.X1) Y=Y0+(Y1-Y0)/(X1-X0)*(X-X0)
      IF((X.GE.X1).AND.(X.LT.X2))Y=Y1+(Y2-Y1)/(X2-X1)*(X-X1)
      IF((X.GE.X2).AND.(X.LT.X3))Y=Y2+(Y3-Y2)/(X3-X2)*(X-X2)
      IF((X.GE.X3).AND.(X.LT.X4))Y=Y3+(Y4-Y3)/(X4-X3)*(X-X3)
      IF((X.GE.X4).AND.(X.LT.X5))Y=Y4+(Y5-Y4)/(X5-X4)*(X-X4)
      IF((X.GE.X5).AND.(X.LT.X6))Y=Y5+(Y6-Y5)/(X6-X5)*(X-X5)
      IF((X.GE.X6).AND.(X.LT.X7))Y=Y6+(Y7-Y6)/(X7-X6)*(X-X6)
      IF((X.GE.X7).AND.(X.LT.X8))Y=Y7+(Y8-Y7)/(X8-X7)*(X-X7)
      IF((X.GE.X8).AND.(X.LT.X9))Y=Y8+(Y9-Y8)/(X9-X8)*(X-X8)
      IF(X.GE.X9) Y=Y9
      RETURN
      END
```

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